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Abstract: The study described perceived breast cancer risk, compared subjective and objective risk estimates, and examined the influence of heuristic reasoning in women's narratives. The survey used three probability scales (Verbal, Comparative, Numerical) and the Gail model to measure perceived and objective risk. Aim 3 was addressed with argument and heuristic reasoning analysis. We recruited a multicultural, educated sample of 184 English-speaking women from community settings. Fifty four provided an in-depth interview. Participants held an optimistic bias regarding their breast cancer risk (comparative optimism and better-than-average), and underestimated their objective risk calculated with the Gail model. Breast cancer worry was a significant predictor of breast cancer risk. Better-educated and higher-income women reported lower levels of worry, while Black women were more likely than Asian and White women to report higher levels of worry, but not higher levels of perceived risk. Most participants did not know that older age is a breast cancer risk factor, and older women did not perceive higher risk. These findings imply that women's knowledge of breast cancer risk factors was incomplete, despite their high educational level. Age and family history are independent predictors of sporadic and hereditary/familial breast cancer risk; yet, women could not distinguish between the two forms of the disease. Most participants (70%) were adherent to mammography and clinical breast exam (CBE) screening guidelines, which can be attributed to high access to screening services and efforts from health care providers. Age, having health insurance, and higher 5-year Gail scores were significant predictors of frequency of screening mammograms and CBEs. Distrust of the health system was the single most important predictor of predisposition to use health services, which in turn was another significant predictor of screening mammograms and CBEs. Interactions among distrust, age, education, and race highlight the importance of distinguishing among racial/cultural, socioeconomic, and cognitive contributors to distrust. Distrust takes the greatest toll among vulnerable groups of women in predisposition to use health services and decision-making regarding breast cancer risk management. Analysis of the 54 interviews revealed that experiences with affected family members and friends, and breast symptoms influence perceived risk though affective and cognitive mechanisms. Distrust of the health care system was also mentioned as a factor that influences utilization of breast cancer screening services. Heuristics (logical shortcuts) facilitated women's risk-assessments. The narrative data provide evidence that supports theories of two systems of reasoning: deliberative and associative reasoning.

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INTRODUCTION
In an effort to eradicate breast cancer, social and behavioral research examines women's motivations to take an active role in protecting themselves from the disease. As health care providers we are interested in taking a closer look at the processes that bring an individual to the doorstep of health care services for breast cancer early detection. Perceived risk is an important motivator for adopting a health-protective behavior, and as an evolving thinking process, is important in decision-making. The primary aims of this project were 1) to describe women's perceived breast cancer risk, 2) to compare their subjective risk estimates with an objective estimate of their risk, and 3) to examine the content and the structure of women's arguments regarding their breast cancer risk assessments and their breast cancer screening behavior. Secondary aims of the project were to explore other behavioral and cognitive factors that influence perceived breast cancer risk and breast cancer screening.

BODY
During the months between May 2003 and May 2004 the following research tasks have been accomplished. Maria Katapodi finalized the survey questionnaire and the interview guide, gained entrée in appropriate recruitment sites, and completed data collection. The project recruited a total of 184 women with a diverse racial/cultural background from community settings. Fifty four of those women agreed to provide an in-depth interview. Maria Katapodi and the research team concluded that conducting further interviews will not be necessary because interview data reached saturation. Forty-five interviews have been transcribed by a professional transcriber.

During the second year of the grant from June 2004 to October 2005 the following tasks have been accomplished. Maria Katapodi submitted three manuscripts for publication, one of which has been published (see Appendix). Maria Katapodi also prepared podium and poster presentations for the following conferences: 8th National Conference on Cancer Nursing Research, 38th Annual Meeting of the Western Institute of Nursing, Era of Hope Department of Defense Conference. Maria Katapodi has also been invited as a Guest Speaker to present findings related to the grant at the 2nd Intersociety Anticancer Convention (Athens, Greece), 6th National Conference of Hellenic Nursing Students (Athens, Greece), and at the Hellenic Anticancer Society, Postgraduate Seminars (Athens, Greece). Moreover, she has been invited as a Guest Lecturer to the University of Athens, Graduate Student's Seminars to lecture on findings related to cancer genetics and health behavior.

During the No Cost Extension from November 2005 to June 2008 Maria Katapodi completed analysis of interview data. Maria Katapodi and the research team have completed additional analyses of quantitative data to address secondary aims of the project. Maria Katapodi presented findings of these analyses as a poster and a podium presentation to the 28th Annual Meeting of the Society of Medical Decision Making and the 9th Cancer Nursing Research Conference of the Oncology Nursing Society, respectively. Finally, aAn abstract has been accepted as a podium presentation to the 2008 National State of the Science Congress in Nursing Research, October 2-4, Washington, D.C.

Descriptive Data Report from Survey Questionnaire

Descriptive data collected from the survey questionnaire have been analyzed using the statistical program SPSS 11.5, SPSS 13, and SPSS 15. A detailed description of these findings has been or will be disseminated with manuscripts:

1. *"Underestimation of breast cancer risk: Influence on screening behavior."* This manuscript is currently under peer review in the *Oncology Nursing Forum*. It addresses specific aims 1) and 2) of the project.

2. *"Experiences with breast cancer, heuristics, and optimistic bias."* This manuscript has been submitted to *Journal of Medical Decision Making* and is currently under revision. It addresses a secondary aim of the project, which is to identify predictors of optimistic bias and to examine whether worry or knowledge act as moderators or mediators between experiences with the disease and optimistic bias.

3. *"Do women in the community recognize hereditary and sporadic breast cancer risk factors?"* This manuscript addresses a secondary aim of the project, which is that women in the community do not have the knowledge to distinguish between sporadic and hereditary cases of breast cancer. This manuscript has been published to *Oncology Nursing Forum, 2005, 32*(3), 617 – 623.

4. *"The influence of worry and emotional characteristics on breast cancer screening."* The manuscript is currently under revision. It describes women's level of breast cancer worry and the contribution of psychological, emotional characteristics on decision-making regarding breast cancer screening

5. *"Distrust and decision making regarding breast cancer screening."* This manuscript has been submitted to *Nursing Research* and is currently under peer-review. The manuscript describes how cognitive biases contribute to initiation and maintenance of distrust to the health care system, which in turn influences decision-making regarding breast cancer screening.

6. *"Perceived risk, worry and habits of using health services as predictors of frequency of breast cancer screening."* This manuscript is currently under preparation. The data analysis highlights how unreasoned cognitive factors, such as habits of using health services, influence frequency of breast cancer screening. The abstract has been accepted as a podium presentation to the 2008 National State of the Science Congress in Nursing Research, October 2-4, Washington, D.C.

Analysis of the data obtained from the survey questionnaire revealed that women recruited in the project are representative of an urban, English-speaking population. Participants were perimenopausal (47±12 years old); 43% self-identified as Non-Hispanic White, 26% as Non-Hispanic Black, 14% as Hispanic, and 17% as Asian. A large percentage (49%) had college education or higher, and their median annual income was between $30,000 and $40,000.

Participants underestimated their actual breast cancer risk, as it was calculated with the online version of the Breast Cancer Risk Assessment Tool (BCRAT). This tool was developed by the National Cancer Institute and it is based on the Gail model. Participants also claimed that they are less likely than their friends/peers to get breast cancer, and that their risk is lower than average. Subjective risk estimations depend on the type of probability scale used for measuring

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perceived risk; responses were most consistent between Verbal and Comparative Scales, and least consistent between Comparative and Numerical Scales. Demographic characteristics influence risk perception only when the latter is measured with a Numerical Scale. This finding suggests that a Numerical Scale is not an appropriate measure to use with educational interventions in the community, because it is most likely misinterpreted. This finding addresses the important issue of systematic measurement errors that was raised from Maria Katapodi and the research team in a previous publication (see Katapodi, Lee, Facione, and Dodd. *Preventive Medicine, 2004, 38*, 388-402). Findings of this analysis were presented as a **Poster presentation** to the 9th Biennial Symposium on Minorities, the Medically Underserved, and Cancer, of the Intercultural Cancer Council, in Washington DC, in March 2004.

Moreover, Maria Katapodi and the research team examined the screening habits of participant women (mammogram, Clinical Breast Exam (CBE), and Breast Self Exam (BSE)) and the impact that perceived breast cancer risk had on women's screening habits. Most participants (77%) had some form of health insurance and 70% of participants over 40 years of age had their most recent mammogram within the last 24 months. However, 10% of participants older than 40 years reported never having a mammogram and only 24% reported performing Breast Self Exam once a month. Demographic characteristics and objective risk factors from the Gail model were not associated with perceived risk. Age, health insurance, and higher 5-year Gail scores correlated with frequency of screening mammogram and CBE. Findings of this analysis and an in-depth interpretation is presented in Manuscript 1, titled "Underestimation of breast cancer risk: Influence on screening behavior", which is currently under peer review in Oncology Nursing Forum. Parts of this analysis were presented as a **Podium presentation** to the 2nd Intersociety Anticancer Convention (Athens, Greece) where Maria Katapodi was an Invited Speaker for a 40-minute lecture, and a **Poster presentation** to the 2005 Era of Hope, Department of Defense Conference.

Participants had moderate levels of worry and moderate knowledge regarding breast cancer risk factors, despite their high educational level. A series of regression analyses revealed that having affected family members and worry were significant predictors of perceived risk for self, while number of affected friends and self-identifying as African American were significant predictors of perceived risk for friends/peers. Having a positive family history, worry, and knowledge of risk factors decreased optimistic bias (Risk for friends/peers – Risk for self), while worry and knowledge of risk factors were moderators for age, having current breast symptoms, one or more breast biopsies, and self-identifying as Latino. Findings of these analyses and an in-depth interpretation is presented in Manuscript 2, titled "Experiences with breast cancer, heuristics, and optimistic bias", which is currently under revision for the Journal of Medical Decision Making. Parts of these analyses were also presented as a **Podium presentation** to the 38th Annual Meeting of the Western Institute of Nursing, and a **Poster presentation** to the 2005 Era of Hope Department of Defense Conference.

A finding of the survey was that participants did not have adequate knowledge to distinguish between hereditary and sporadic breast cancer risk factors. This finding becomes even more significant if we consider that 49% had at least four years of college education. Participants were

not likely to receive genetic counseling or any form of genetic education, since only 9% had multiple affected family members, which is indicative of the hereditary form of the disease. Therefore, most women depended on their primary care providers (physicians and nurse practitioners) for personalized breast cancer risk assessment and education. Our findings indicate that participants did not know that having an affected family member from the father's side of the family increases breast cancer risk, they did not know the connection between breast and ovarian cancer, and did not understand the interplay between family history and age as risk factors. Findings of this analysis and an in-depth interpretation is presented in Manuscript 3, titled "Do women in the community recognize hereditary and sporadic breast cancer risk factors?" that was published in *Oncology Nursing Forum, 2005, 32*(3), 617 – 623. Moreover, this analysis was a **Podium presentation** to the 8th National Conference on Cancer Nursing Research, a **Podium presentation** to the 38th Annual Meeting of the Western Institute of Nursing, and a **Poster presentation** to the 2005 Era of Hope Department of Defense Conference.

An unexpected finding of the survey was that breast cancer worry was a significant predictor of perceived breast cancer risk and breast cancer screening. Therefore, Maria Katapodi examined predictors of breast cancer worry. Findings indicated that women with higher education and higher income were more likely to report lower levels of worry, whereas Black women were more likely than Asian and White women to report higher levels of worry, but not higher levels of perceived risk. Predictors of worry included annual income and affective characteristics, such as positive affect. Worry, affect intensity, behavioral inhibition, experiential thinking, and fun seeking correlated significantly with screening behaviors. Findings of this analysis were titled "Affective characteristics as predictors of breast cancer screening" and were a **Poster presentation** to the 2005 Era of Hope Department of Defense Conference. Preparation of a manuscript that addresses this analysis is currently underway.

Based on theoretical suggestions, we examined whether distrust of the health care system influence an individual's predisposition to use health services and decision-making regarding breast cancer risk management. We measured the cognitive processes that constitute the psychological mechanism of the "asymmetry principle" and contribute to the self-reinforcing and self-perpetuating attributes of distrust and predisposition to use health services. Distrust of the health care system was the single most important predictor of predisposition to use health services, which in turn was a significant predictor of breast cancer screening behavior. Observed interactions among distrust, age, education, and race highlight the importance of distinguishing among racial/cultural, socioeconomic, and cognitive contributors to distrust. Findings indicate that distrust takes the greatest toll among vulnerable groups of women in predisposition to use health services and decision-making regarding breast cancer risk management. Findings of this analysis are presented in a manuscript, titled: "Distrust, habits of using health services, and decision making regarding breast cancer screening", which is currently under peer-review for *Nursing Research*. Different parts of this analysis were presented as a **Podium presentation** to the 9th Cancer Nursing Research Conference of the Oncology Nursing Society, and a **Poster presentation** to the 28th Annual Meeting of the Society of Medical Decision Making.

The benefits of screening mammograms and Clinical Breast Exams (CBEs) are increased with frequent performance. The factors that determine frequency of breast cancer screening may be different from those that determine its initiation. Perceived risk and worry are significant determinants of initiation of breast cancer screening. Based on theoretical suggestions (Ronis, Yates et al. 1989), we examined whether habits of using health services predict frequency of breast cancer screening. Habits of using health services explained a greater percentage of the variance of frequency of mammograms and frequency of CBEs, compared with perceived breast cancer risk and breast cancer worry. Findings of this analysis will be presented in a **Podium presentation** to the 2008 National State of the Science Congress in Nursing Research, October 2-4, Washington, D.C.

Finally, analysis of narrative data obtained from the 54 in-depth interviews suggested that participants used common heuristics and common cognitive strategies in order to make their risk assessments. Distrust of the health care system was often mentioned as a factor that inhibits utilization of breast cancer screening services. The cognitive mechanism termed search for a dominance structure played an important role in symptom labeling and when women assessed whether they are more at risk for developing breast cancer or another disease. Heuristic reasoning facilitated creating stereotypical images of high risk individuals; women compared their risk with the risk of stereotypes of high risk women. Affective elements and the associative, contextual system of thinking played an important role during information retrieval and information processing. Findings of this analysis will be presented in a manuscript.

KEY RESEARCH ACCOMPLISHMENTS

- Complete data collection
- Data have been entered into SPSS files
- Data obtained from the survey questionnaire has been analyzed
- Data analysis from the survey questionnaire addressed specific aims 1) and 2)
- Data analysis also addressed four secondary aims of the project
- Interview data have been collected. All interviews have been transcribed. Analysis and coding of the interview data has been completed.
- Analysis of the data obtained from the project enabled Maria Katapodi to complete her PhD degree
- One published manuscript
- Two manuscripts Under Peer Review
- One manuscript Under Revision
- Three manuscripts are in the process of preparation and submission for publication
- Poster presentations to the 9th Biennial Symposium on Minorities, the Medically Underserved, and Cancer, of the Intercultural Cancer Council, in Washington DC, March 2004, the Era of Hope Department of Defense Conference in Philadelphia, PN, June 2005, and the 28th Annual Meeting of the Society of Medical Decision Making, Boston MA, October 2006.

- Podium presentations to the 8th National Conference on Cancer Nursing Research, Ft Lauderdale, FL, February 2005, the 2nd Intersociety Anticancer Convention in Athens, GREECE, March 2005, the 38th Annual Meeting of the Western Institute of Nursing, San Francisco, CA, April 2005, the 9th National Conference of Cancer Nursing Research, Hollywood, CA, February 2007, and the 2008 National State of the Science Congress in Nursing Research, Washington D.C., October 2008.

REPORTABLE OUTCOMES

- **Poster** presentation: "Optimistic bias regarding the risk of developing breast cancer in a multicultural community sample". 9th Biennial Symposium on Minorities, the Medically Underserved, and Cancer, of the Intercultural Cancer Council, in Washington DC, March 2004.
- **Poster** presentation: "Better-than-average and Comparative-optimism biases in a community sample: Effects on breast cancer screening". Era of Hope, Department of Defense Conference, Philadelphia, PN, June 2005.
- **Poster** presentation: "Predictors of breast cancer worry: Sociodemographic and affective characteristics". Era of Hope, Department of Defense Conference, Philadelphia, PN, June 2005.
- **Poster** presentation: "Knowledge of sporadic and genetic breast cancer risk factors among women in the community". Era of Hope, Department of Defense Conference, Philadelphia, PN, June 2005.
- **Poster** presentation: "How do experiences with affected family members, affected friends, and breast symptoms influence perceived breast cancer risk?" Era of Hope, Department of Defense Conference, Philadelphia, PN, June 2005.
- **Podium** presentation: "Do women in the community recognize hereditary and sporadic breast cancer risk factors?" 8th National Conference on Cancer Nursing Research, Ft Lauderdale, FL, February 2005.
- **Podium** presentation: "Πρόληψη καρκίνου μαστού: Αντιλαμβάνονται οι γυναίκες τον κίνδυνο εμφάνισής του;" or "Breast cancer early detection: Do women realize their risk for developing the disease?" 2nd Intersociety Anticancer Convention in Athens, GREECE, March 2005.
- **Podium** presentation: "How do experiences with affected family members, affected friends, and breast symptoms influence perceived breast cancer risk?" 38th Annual Meeting of the Western Institute of Nursing, San Francisco, CA, April 2005.
- **Poster** presentation: "Distrust and decision making regarding breast cancer screening". 28th Annual Meeting of the Society of Medical Decision Making, Boston, MA, October 2006.
- **Podium** presentation: "Perceived risk, worry & habits of using health services as predictors of frequency of breast cancer screening." National State of the Science Congress in Nursing Research, Washington D.C., October 2008.

- **Published Manuscript** titled: "Do women in the community recognize hereditary and sporadic breast cancer risk factors?" published in *Oncology Nursing Forum, 2005, 32*(3), 617 – 623.
- **Manuscript under Peer Review:** "Underestimation of breast cancer risk: Influence on screening behavior." Oncology Nursing Forum.
- **Manuscript under Peer Review:** "Distrust and decision making regarding breast cancer screening." Nursing Research.

CONCLUSION

The project was finished on-time with the approved statement of work and the requested No Cost Extension. Our findings suggested that participant women in the community had an optimistic bias and underestimated their breast cancer risk. Our findings also addressed important issues regarding systematical measurement errors that have been raised in a previously published manuscript. Although women that have personal experiences with the disease, such as women with affected family members, those who know of other women with the disease, or those who have experienced abnormal breast symptoms themselves, are less likely to underestimate their risk. Our findings suggested areas that need further research and intervention. Participants in the community had a lack of knowledge regarding breast cancer risk factors, while breast cancer worry was a strong predictor of perceived risk. Women with lower education and lower income were more likely to report higher levels of worry, which suggests that these vulnerable groups of women might suffer an unnecessary anxiety regarding their breast cancer risk. Distrust of the health system is an indirect barrier to breast cancer screening, since it was the single most important negative predictor of using health services. In turn, habits of using health services explained a greater percentage of the variance in frequency of mammograms and frequency of CBEs than perceived risk and worry. Distrust of the health care system might take a great toll on vulnerable and socioeconomically disadvantaged women. Cognitive biases contribute to the self-reinforcing and self-perpetuating nature of distrust of the health care system. Analysis of the interview data provided further insights into the cognitive and affective processes that accompany information-processing and decision-making processes about breast cancer risk and breast cancer screening behaviors.

Educational interventions should take into account affective reactions and cognitive factors related to information processing. For example, cognitive interventions should address deliberate and associative reasoning regarding women's perceived breast cancer risk and reinforce habits of using health services. Although existing educational interventions provide information regarding breast cancer risk factors, we need to further improve the format with which information is being presented, so that it is accessible when women estimate their breast cancer risk. Addressing the cognitive processes that possibly reinforce distrust to the health care system is an area that needs further investigation.

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APPENDIX

Bibliography of Meeting Abstracts

1. BETTER-THAN-AVERAGE AND COMPARATIVE-OPTIMISM BIASES IN A COMMUNITY SAMPLE. EFFECTS ON BREAST CANCER SCREENING
2. HOW DO EXPERIENCES WITH AFFECTED FAMILY MEMBERS, AFFECTED FRIENDS, AND BREAST SYMPTOMS INFLUENCE PERCEIVED BREAST CANCER RISK?
3. KNOWLEDGE OF SPORADIC AND GENETIC BREAST CANCER RISK FACTORS AMONG WOMEN IN THE COMMUNITY
4. AFFECTIVE CHARACTERISTICS AS PREDICTORS OF BREAST CANCER SCREENING
5. ΠΡΟΛΗΨΗ ΚΑΡΚΙΝΟΥ ΜΑΣΤΟΥ : ΑΝΤΙΛΑΜΒΑΝΟΝΤΑΙ ΟΙ ΓΥΝΑΙΚΕΣ ΤΟΝ ΚΙΝΔΥΝΟ ΕΜΦΑΝΙΣΗΣ ΤΟΥ; (Breast cancer early detection: Do women recognize the risk of developing breast cancer?)
6. DISTRUST AND DECISION MAKING REGARDING BREAST CANCER SCREENING
7. PERCEIVED RISK, WORRY & HABITS OF USING HEALTH SERVICES AS PREDICTORS OF FREQUENCY OF BREAST CANCER SCREENING

BETTER-THAN-AVERAGE AND COMPARATIVE-OPTIMISM BIASES IN A COMMUNITY SAMPLE. EFFECTS ON BREAST CANCER SCREENING

Abstract

Background: Although perceived risk affects health-protective behaviors, it is not clear whether women believe their breast cancer risk to be high or low, and whether absolute or comparative risk judgments have greater impact on screening behavior. **Purpose:** 1) describe absolute and comparative breast cancer risk judgments, 2) examine consistency of responses across different risk measures, 3) compare subjective to objective risk estimates, and 4) examine the influence of risk judgments on screening behavior. **Methods:** The survey used two absolute and three comparative probability scales and the Gail model to measure perceived risk and objective risk estimates in a community sample of 184 women (age 47±12). **Results:** The Verbal and Comparative scales indicated that participants believed their breast cancer risk to be lower than average (p<0.01) and the risk for friends/peers higher than their own (p<0.01). Most responses (63%) on the Numerical scale clustered around a 12% risk estimate, whereas there was no optimistic bias (p=NS). Responses were consistent between the Verbal and the Comparative scales. While 60% had received adequate screening, women underestimated their actual risk (p<0.01). However, neither absolute nor comparative risk estimates influenced screening behavior. Women whose most recent mammogram or Clinical Breast Exam was performed for the evaluation of a breast symptom perceived higher risk. **Conclusions:** Four different measures indicated that women recruited from community settings underestimate their breast cancer risk. Comparative and Verbal scales better reflect perceived risk than Numerical scales. However, risk judgments did not influence screening behavior, which has implications for risk communication.

Word Count: 249

HOW DO EXPERIENCES WITH AFFECTED FAMILY MEMBERS, AFFECTED FRIENDS, AND BREAST SYMPTOMS INFLUENCE PERCEIVED BREAST CANCER RISK?

Abstract

Background: Although having a family history of breast cancer, worry, and breast symptoms are related to a heightened perception of risk, it is not clear why some women underestimate their risk in the presence of risk factors. **Purpose:** To examine whether experiences with affected family members, affected friends, and breast symptoms influence perceived risk and whether worry and knowledge of breast cancer risk factors moderate the relationships between experiences and perceived risk. **Method:** We recruited 184 women (age 47 ± 12) from community settings and inquired about their family history and number of affected friends. Experiences with breast symptoms were assessed with number of breast biopsies, current symptoms, and reasons for women's most recent mammogram and clinical breast exam. We assessed worry with a 4-scale instrument (Cronbach's alpha 0.85), knowledge of risk factors with a13-item index (Cronbach's alpha 0.80), and perceived risk with a Principal Component Analysis of three probability measures (Cronbach's alpha 0.70). **Results:** Hierarchical regression analyses revealed that having an affected family member, affected friends, and abnormal breast symptoms predicted heightened perceived risk and accounted for 6%, 2%, and 5% of the variance in perceived risk respectively ($p<0.05$). Worry accounted for 7% and the interaction of worry with knowledge of risk factors accounted for an additional 5% of the variance in perceived risk ($p<.05$). Worry and knowledge of breast cancer risk factors moderated the relationships between experiences and perceived risk. **Conclusions:** We discuss mechanisms with which experiences, worry, and knowledge influence perceived breast cancer risk and implications for risk communication interventions.

Word count: 251

KNOWLEDGE OF SPORADIC AND GENETIC BREAST CANCER RISK FACTORS AMONG WOMEN IN THE COMMUNITY

Abstract

Background: In light of the rapid evolution in cancer genetics and in order for health educators to plan future interventions, it is important to track changes in knowledge regarding breast cancer risk factors and the extent that information has been integrated into women's perceptions. **Purpose:** 1) describe knowledge of hereditary/familial and sporadic breast cancer risk factors, and 2) identify factors associated with knowledge of these risk factors. **Methods:** This community-based survey recruited 184 women (age 47±12), who have never been diagnosed with cancer to completed a questionnaire in English. Participants were 43% European-descent, 26% African-descent, 17% Asian-descent, and 14% Hispanic. Most (49%) were college graduates and had an annual family income between $30,000 and $40,000. We assessed knowledge of hereditary/familial and sporadic breast cancer risk factors with a 13-item index (Cronbach's alpha 0.80). **Results:** Although most women recognized the role of heredity as a risk factor, some did not understand the impact of paternal family history on one's risk. Some did not recognize the relation between breast and ovarian cancer, risk factors associated with the Gail model, and that getting older increases one's risk. Level of education was significantly associated with knowledge of risk factors. **Conclusions:** Although this was a sample of educated women, their knowledge of breast cancer risk factors appeared incomplete. Age and family history are independent predictors of sporadic and hereditary/familial breast cancer risk; yet, women could not distinguish between the two forms of the disease. Primary care providers should provide individualized risk assessment and education regarding breast cancer risk factors.

Word Count: 254

AFFECTIVE CHARACTERISTICS AS PREDICTORS OF BREAST CANCER SCREENING

Abstract

Background: The risk-as-feelings hypothesis suggests that decision-making and risk judgments are influenced by anticipated emotions (a consequence of an outcome) and by anticipatory emotions (experienced during the decision-making process). **Purpose:** To describe breast cancer worry and other affective characteristics, to examine predictors of worry, and examine the influence of cancer specific and general affect on screening behavior. **Methods:** We recruited 184 women (age 47±12) from diverse racial backgrounds (57% minority) from community settings; most were highly-educated (49% attended college) with an annual income of $30,000-$40,000. Besides Worry, we assessed Affect Intensity, Fun Seeking, Behavioral Inhibition, predisposition to Experiential and to Rational Thinking, Social Desirability, and Positive and Negative Affect. **Results:** Women with higher education and higher income were more likely to report lower levels of worry ($r = -.24$, $r = -.30$, respectively $p<0.01$). Black women were more likely than Asian and White women to report higher levels of worry $F_{(3,180)} = 4.82$, $p=.003$ ($p=.008$ and $p=.014$, respectively), whereas there were no differences among women of other races/cultures. Worry correlated positively with Affect Intensity ($r = .15$, $p<.05$), Behavioral Inhibition ($r = .19$, $p<.05$), and Negative Affect ($r = .26$, $p<.01$), and negatively with Positive Affect ($r = -.18$, $p<.01$). A two-step simultaneous multiple regression revealed that annual income and Positive Affect were significant predictors of worry ($p=.007$ and $p=.014$, respectively) and the overall model predicted 25% of the variance in worry. Worry, Affect Intensity, Behavioral Inhibition, Experiential Thinking, and Fun Seeking correlated with screening behaviors ($p<0.05$). **Conclusions:** Worry and other affective characteristics appear to act as anticipatory emotions that influence the decision-making process for breast cancer screening.

World count: 262

ΠΡΟΛΗΨΗ ΚΑΡΚΙΝΟΥ ΜΑΣΤΟΥ : ΑΝΤΙΛΑΜΒΑΝΟΝΤΑΙ ΟΙ ΓΥΝΑΙΚΕΣ ΤΟΝ ΚΙΝΔΥΝΟ ΕΜΦΑΝΙΣΗΣ ΤΟΥ;
Περίληψη Εργασίας (English Abstract Follows)

Ανασκόπηση: Η αντίληψη κινδύνου θεωρείται μία από τις σημαντικές μεταβλητές που επηρεάζουν την συμπεριφορά της υγείας. Όμως δεν υπάρχει ομοφωνία μεταξύ επιστημονικών μελετών για το εάν οι γυναίκες αντιλαμβάνονται τον κίνδυνο εμφάνισης καρκίνου μαστού, και εάν υποτιμούν ή υπερεκτιμούν τις πιθανότητες να εμφανίσουν τη νόσο.

Σκοποί της παρούσας έρευνας είναι: 1) να περιγράψει εάν οι γυναίκες αντιλαμβάνονται τον κίνδυνο εμφάνισης καρκίνου μαστού, 2) να εξετάσει εάν υπάρχει συνοχή μεταξύ των απαντήσεων σε τρείς διαφορετικές κλίμακες που συμπλήρωσαν οι γυναίκες που συμμετείχαν στην έρευνα, 3) να συγκρίνει τις υποκειμενικές εκτιμήσεις κάθε γυναίκας για την πιθανότητα να εμφανίσει καρκίνο μαστού με την αντικειμενική πιθανότητα να εμφανίσει τη νόσο, και 4) να εξετάσει αν η αντίληψη κινδύνου επηρεάζει την συμπεριφορά της υγείας, συγκεκριμένα τη συχνότητα διενέργειας μαστογραφίας, κλινικής εξέτασης μαστού, και αυτοεξέτασης μαστού.

Μέθοδος: Η παρούσα έρευνα είναι επιδημιολογικής φύσεως και διεκπεραιώθηκε στο Σαν Φρανσίσκο των Η.Π.Α. από το Μάρτιο του 2003 έως και το Φεβρουάριο του 2004. Δεδομένα συγκεντρώθηκαν με ερωτηματολόγια από γυναίκες που στρατολογήθηκαν για την έρευνα με διαφημιστικά φυλλάδια από χώρους που επισκέπτονταν στην καθημερινή τους ζωή (οίκους ευγηρίας, εκκλησίες, Βουδιστικούς ναούς, δημόσιες βιβλιοθήκες, εστιατόρια κ.λ.π.), και με προβολή της έρευνας σε τοπικές εφημερίδες που έχουν πολυφυλετικό αναγνωστικό κοινό. Διαφημίσαμε την έρευνα ως «Έρευνα για την Υγεία του Μαστού» και γυναίκες μπορούσαν να συμμετάσχουν εάν ήταν ηλικίας 30 έως 85 ετών, δεν είχαν προσωπικό ιστορικό καμμίας μορφής καρκίνου, συμφωνούσαν να συμπληρώσουν ένα ερωτηματολόγιο στα Αγγλικά, και η νοητική τους κατάσταση τους επέτρεπε να δώσουν γραπτή συγκατάθεση για τη συμμετοχή τους στην έρευνα. Χρησιμοποιήσαμε τη μέθοδο του τριγωνισμού με τρεις διαφορετικές κλίμακες με τις οποίες οι γυναίκες που συμμετείχαν στην έρευνα αξιολόγησαν την πιθανότητα να εμφανίσουν καρκίνο μαστού: Λεκτική, Αριθμητική, και Συγκριτική κλίμακα. Υπολογίσαμε την αντικειμενική πιθανότητα κάθε γυναίκα να εμφανίσει καρκίνο μαστού χρησιμοποιώντας το μοντέλο Gail.

Δείγμα: Ερωτηματολόγια συμπληρώθηκαν από 184 γυναίκες (μέση ηλικία 47±12, 30 – 85 έτη) που ανήκαν σε διάφορες φυλές (43% Λευκή φυλή, 26% Μαύρη φυλή, 17%Ασιατική φυλή, και 14% Λατίνες). Οι περισσότερες γυναίκες (51%) είχαν τελειώσει πανεπιστήμιο ή άλλο κολλέγιο τριτοβάθμιας εκπαίδευσης και το διάμεσο οικογενειακό τους εισόδημα ήταν μεταξύ $30,000 και $40,000. Μερικές γυναίκες (6%) είχαν θετικό οικογενειακό ιστορικό καρκίνου μαστού σε συγγενή πρώτου βαθμού, περίπου 20% είχαν θετικό οικογενειακό ιστορικό σε συγγενή δευτέρου βαθμού, και 6% είχαν θετικό οικογενειακό ιστορικό σε συγγενείς πρώτου και δεύτερου βαθμού.

Αποτελέσματα: Οι περισσότερες γυναίκες πίστευαν ότι ο προσωπικός τους κίνδυνος να εμφανίσουν καρκίνο μαστού είναι μικρότερος από τον μέσο όρο. Συστηματικά, θεωρούσαν ότι έχουν μικρότερο κίνδυνο να εμφανίσουν τη νόσο από άλλες γυναίκες της ηλικίας τους και από γυναίκες που γνωρίζουν στην καθημερινή τους ζωή, όπως οι συνεργάτες και οι φίλες τους (p<0.01). Υπήρχε περισσότερη συνοχή μεταξύ των απαντήσεων τους στη Λεκτική και τη Συγκριτική κλίμακα (p<0.01), ενώ η λιγότερη συνοχή παρατηρήθηκε μεταξύ της Συγκριτικής

και της Αριθμητικής κλίμακας (p=NS). Υπολογισμός της αντικειμενικής πιθανότητας εμφάνισης καρκίνου μαστού συνιστά ότι οι γυναίκες που απάρτησαν το δείγμα της έρευνας είχαν συνολικά κίνδυνο εμφάνισης καρκίνου μαστού μεγαλύτερο από το μέσο όρο του πληθυσμού. Σύγκριση μεταξύ αντικειμενικής και υποκειμενικής εκτίμησης πιθανότητας εμφάνισης της νόσου συνιστά ότι οι γυναίκες υποτιμούσαν την πιθανότητα να εμφανίσουν τη νόσο (p<0.001). Δεν βρήκαμε σημαντικές συσχετίσεις μεταξύ αντίληψης κινδύνου και συμπεριφοράς της υγείας. Μόνο οι γυναίκες που είχαν την πιο πρόσφατη κλινική εξέταση μαστού για την διερεύνηση ενός κλινικού συμπτώματος, το οποίο αποδείχτηκε ότι δεν ήταν κακοήθεια, ήταν σημαντικά πιό πιθανό να πιστεύουν ότι διατρέχουν μεγαλύτερο κίνδυνο από τον καρκίνο μαστού (p<0.05).

Συμπεράσματα: Δείξαμε με τρεις διαφορετικού τρόπους ότι οι γυναίκες υποτιμούν την πιθανότητα εμφάνισης καρκίνου μαστού και διατηρούν μία μη-ρεαλιστική αισιοδοξία ότι δεν κινδυνεύουν από τη νόσο. Η Λεκτική και η Συγκριτική κλίμακες αποδίδουν καλύτερα την υποκειμενική αντίληψη κινδύνου εμφάνισης καρκίνου μαστού από την Αριθμητική κλίμακα και μάλλον θα πρέπει να προτιμούνται σε εκπαιδευτικές παρεμβάσεις που σκοπό έχουν την εκπαίδευση γυναικών σχετικά με παράγοντες κινδύνου, πρόληψη της νόσου, και πιθανότητα εμφάνισής της. Η αντίληψη κινδύνου επηρεάζει την συμπεριφορά της υγείας κάτω από ορισμένες προϋποθέσεις. Συγκεκριμένα, γυναίκες που ζήτησαν άμεση ιατρική βοήθεια για την διερεύνηση κλινικού ευρήματος στο μαστό, το οποίο ανακάλυψαν μόνες τους, ήταν σημαντικά πιο πιθανόν να πιστεύουν ότι υπάρχει πιθανότητα να προσβληθούν από τη νόσο.
Αριθμός Λέξεων: 687

Abstract
Background: Perceived risk affects health-protective behaviors. Research findings are conflicting as to whether women believe their breast cancer risk to be high or low.

Purpose: to 1) describe perceived breast cancer risk, 2) examine consistency of responses across different risk measures, 3) compare subjective and objective risk estimates, and 4) examine the influence of perceived risk on screening behavior.

Methods/Sample: This cross-sectional, triangulation study took place in the San Francisco Bay Area between March 2003 and February 2004. We recruited 184 women (mean age 47±12, range: 30-85) from community settings that women were likely to visit in their daily living and through newspaper advertisements targeting ethnic/cultural minority groups. Women were eligible to participate if they were between the ages 30 and 85, had no priori history of any type of cancer, agreed to complete the questionnaire in English, and were mentally able to provide informed consent. Participants were from diverse racial/cultural backgrounds (43% White, 26% Black, 17% Asian, 14% Hispanic) and most (51%) were college graduates. The median annual income was between $30,000 and $40,000. We used three probability scales (Verbal, Comparative, and Numerical) (Diefenbach, Weinstein et al. 1993) and the Gail model (Gail, Brinton et al. 1989; Gail and Constantino 2001) to measure Perceived Risk and Objective Risk respectively. Some women (6%) had a positive family history of breast cancer in a first-degree relative, approximately 20% had a positive family history in a second-degree relative, and 6% had a positive family history in both first- and second-degree relatives.

Results: Participants believed that their breast cancer risk was lower than average and rated the risk for friends/peers higher than their own (Optimistic Biases, p<0.01). Responses

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were most consistent between Verbal and Comparative scales ($p<0.01$). Participants underestimated their actual risk ($p<0.001$). Women who had their most recent Clinical Breast Exam (CBE) for the evaluation of a breast problem were more likely to perceive higher risk ($p<0.05$).

Conclusions: We demonstrated that women in the community hold optimistic biases and underestimate their actual breast cancer risk in three different ways. Comparative and Verbal risk scales better reflect perceived risk than Numerical scales. Perceived risk affects screening behavior under specific conditions, namely it encourages women to seek medical evaluation for a self-discovered breast symptom.

Word count: 364
Keywords: breast cancer, perceived risk, optimistic bias, Gail model, triangulation

DISTRUST AND DECISION MAKING REGARDING BREAST CANCER SCREENING

We recruited 184 women (age 47±12) from community settings to examine whether distrust of the health care system and personal experiences with prejudicial treatment influence an individual's predisposition to use health services and decision-making regarding breast cancer risk management. Most women (49%) were college educated, 22% were low income, 77% had health insurance, and 57% were from minority backgrounds with an over-representation of non-Hispanic Blacks. We measured the cognitive processes that constitute the psychological mechanism of the "asymmetry principle" and contribute to the self-reinforcing and self-perpetuating attributes of distrust (Cronbach alpha=0.71), personal experiences with prejudice in the health care system (Cronbach alpha=0.71), and predisposition to use health services (Cronbach alpha=0.84). Regression analyses revealed that distrust of the health care system was the single most important predictor of predisposition to use health services, which in turn was a significant predictor of breast cancer screening behavior. Observed interactions among distrust, perceived prejudice, age, education, and race highlight the importance of distinguishing among racial/cultural, socioeconomic, and cognitive contributors to distrust. Findings indicate that distrust takes the greatest toll among vulnerable groups of women in predisposition to use health services and decision-making regarding breast cancer risk management.
Word Count: 193

Keywords: Asymmetry principle, distrust in the health care system, predisposition to use health services, breast cancer screening

PERCEIVED RISK, WORRY & HABITS OF USING HEALTH SERVICES AS PREDICTORS OF FREQUENCY OF BREAST CANCER SCREENING

Effective cancer control is influenced by factors associated with maintenance of screening behaviors. The benefits of breast cancer early detection are increased with consistent and frequent performance of screening mammograms and Clinical Breast Exams (CBEs). Research findings suggest that perceived breast cancer risk and worry have a significant effect on breast cancer screening. However, reported effect sizes of perceived risk and worry on screening mammograms were small (Katapodi, Lee, Facione, Dodd, 2004), indicating that a large amount of variance in decisions to pursue frequent breast cancer screening remains unexplained.
Aims: The study used the Theory of Repeated Behaviors to examine whether:
1) Perceived breast cancer risk, breast cancer worry, and habits of using health services predict frequency of breast cancer screening
2) Perceived risk, worry, and habits of using health services operate independently of each other or they interact in predicting frequency of screening

Methods: This community-based, cross-sectional survey recruited a multicultural sample (57% non-White) of 184 women (47±12, range: 30-84), who have never been diagnosed with cancer, to complete a questionnaire in English. We assessed perceived breast cancer risk with one item; breast cancer worry with a four-item scale (Cronbach's $\alpha = 0.85$); habits of using health services with an eleven-item scale (Cronbach's $\alpha = 0.85$). Frequency of screening mammograms (N=115 ≥40y.o.) and CBEs (N=184) was based on self-report. Hierarchical regression models, after controlling for demographics and access to health services, assessed whether perceived risk, worry, habits of using health services, and their interaction predicted frequency of either screening behavior.

Results: After accounting for demographics and variables affecting access to care, the most significant predictor of frequent mammograms and CBEs was habits of using health services. There were no significant interactions among predictor variables.
Implications: Commonly used theoretical models do not address maintenance of behaviors. Findings of the study suggest that frequency of breast cancer screening is influenced mostly by habits of using health services, and to a lesser degree by perceived risk and worry. Decision-making research regarding adoption and maintenance of health-protective behaviors should examine factors that enhance habitual use of health services.

Word Count: 345

Bibliography of Manuscripts

1. DO WOMEN IN THE COMMUNITY RECOGNIZE HEREDITARY AND SPORADIC BREAST CANCER RISK FACTORS?
2. UNDERESTIMATION OF BREAST CANCER RISK: INFLUENCE ON BREAST CANCER SCREENING
3. DISRUST AND DECISION MAKING REGARDING BREAST CANCER SCREENING
4. EXPERIENCES WITH BREAST CANCER, HEURISTICS, AND OPTIMISTIC BIAS

Do Women in the Community Recognize Hereditary and Sporadic Breast Cancer Risk Factors?

Maria C. Katapodi, RN, MSc, PhD, and Bradley E. Aouizerat, PhD

Purpose/Objectives: To describe knowledge of hereditary, familial, and sporadic breast cancer risk factors among women in the community and to identify characteristics associated with this knowledge.

Design: Descriptive, cross-sectional.

Setting: Community settings in the San Francisco Bay Area.

Sample: 184 women who had never been diagnosed with cancer, were 30–85 years old ($\bar{X}$ = 47 ± 12), and agreed to complete a questionnaire in English. Participants were from diverse racial and cultural backgrounds (i.e., 43% European descent, 27% African descent, 16% Asian descent, and 14% Hispanic descent). Many (49%) were college graduates, and 24% had a median annual family income of $30,000–$50,000.

Methods: Survey.

Main Research Variables: Knowledge of hereditary, familial, and sporadic breast cancer risk factors and characteristics associated with this knowledge.

Findings: Although most women recognized heredity as a risk factor, some did not understand the impact of paternal family history on risk. Some women did not recognize the relationship between breast and ovarian cancer, risk factors associated with the Gail model, and that aging increases risk. Education level was the most important characteristic associated with knowledge of risk factors.

Conclusions: Although age and family history are independent predictors of sporadic, hereditary, and familial breast cancer risk, women in the community could not distinguish between the three forms of the disease. Although the sample included a large number of educated women, their knowledge of breast cancer risk factors appeared incomplete.

Implications for Nursing: Advanced practice nurses should provide individualized risk assessment and education regarding breast cancer risk factors.

Key Points . . .

➤ Women's knowledge of breast cancer risk factors is incomplete, and some risk factors are overlooked.

➤ Women in the community do not seem to recognize the difference among hereditary, familial, and sporadic breast cancer.

➤ Advanced practice nurses should provide individualized counseling and education regarding hereditary, familial, and sporadic breast cancer.

➤ Reevaluation of the accuracy of breast cancer risk factor literature is necessary.

Breast cancer is the leading cancer diagnosed among women in the United States, and the American Cancer Society (2005) estimated that more than 210,000 women will be diagnosed with the disease in 2005. The disease currently is divided into three categories based on its underlying etiology. Hereditary breast cancer comprises 5%–10% of cases and is attributed to known genetic mutations (e.g., genetic lesion in breast cancer genes, *BRCA1*, *BRCA2*). Familial breast cancer comprises 20%–25% of cases and is associated with a positive family history, but no known genetic mutation can be identified. Sporadic breast cancer, for which no discernible heritability can be established, comprises approximately 70% of cases (American Cancer Society).

Research has identified factors that put women at risk for developing the disease. The most important overall risk factor for sporadic cases is age, and a majority of cases develops in women 50 years and older. Women of European descent appear to be at higher risk compared with other racial groups. Other identified risk factors include a previous

breast cancer diagnosis, family history of breast or ovarian cancer, atypical hyperplasia or lobular carcinoma in situ, and genetic factors, which are more prevalent in women of Ashkenazi Jewish descent. Suggested risk factors include exposure to hormones (e.g., estrogen replacement, early menarche), late parity (i.e., after age 30), dense breast tissue, alcohol use, and postmenopausal obesity (American Cancer Society, 2005).

Some discrepancy exists about whether information aimed at raising awareness about breast cancer risk factors has been integrated successfully into women's perceptions. A lack of balance in the mass media's presentation of certain aspects of breast cancer may affect community perceptions (Gottlieb, 2001). In light of the rapid evolution in cancer genetics, tracking changes in the knowledge regarding breast cancer risk factors is important. As the area of breast cancer research continues to expand and educational materials are developed and made available to the lay public and the professional community, healthcare educators should examine how specific knowledge about breast cancer has been understood and incorporate their findings into future planning.

Given this information, the current study explored community knowledge about breast cancer risk factors. The specific objectives were to describe women's knowledge of hereditary,

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familial, and sporadic breast cancer risk factors and to identify characteristics associated with this knowledge.

Literature Review

Efforts to promote breast cancer screening and early detection rely on dissemination of information about the disease, its risk factors, and the importance of screening. Much of this effort is made through press releases, television and radio broadcasts, and articles and advertisements in women's magazines (Curry, Byers, & Hewitt, 2003). Research has shown that, independent of physicians' advice, the media influences women's decisions to have mammograms (Yanovitzky & Blitz, 2000) and that a correlation exists between community newspaper advertisements and mammography use (Urban et al., 1995). However, others have concluded that although messages in the media can heighten awareness and increase behavioral intention, they are unlikely to assert any influence beyond awareness of breast cancer screening (Rimer, 1997). A meta-analysis summarizing the results of interventions that aimed to raise screening rates and knowledge of risk factors concluded that behavioral interventions increase the rate of breast cancer screening by 13%. Cognitive interventions that used generic education strategies had little impact, but those that used theory-based education increased screening rates by 24% (Yabroff & Mandelblatt, 1999).

Low-income and minority women are more likely to benefit significantly from educational programs (Hiatt & Pasick, 1996). For instance, among high-risk women of African descent, those who declined genetic counseling had considerably less knowledge of breast cancer genetics and associated risk factors than those who accepted genetic counseling and genetic testing (Thompson et al., 2002). Several studies provided evidence that differences in knowledge regarding risk factors exist among sociodemographically diverse samples of women (Campbell, 2002; Donovan & Tucker, 2000; Magai, Consedine, Conway, Negut, & Culver, 2004).

Therefore, an increasing need exists for refinement of outreach and intervention efforts and for continuous monitoring of the knowledge levels among community women, especially those from racially or culturally diverse communities. This study examined knowledge of risk factors for hereditary, familial, and sporadic breast cancer among community women from diverse racial or cultural backgrounds.

Theoretical Framework

Weinstein (1988) suggested that a person who knows little about a health problem and its associated risk factors will be open-minded to learning about it. In contrast, a person who is aware of the health problem but does not consider specific situations to be risk factors will not be open-minded. This person's commitment to a particular point of view tends to produce a biased response; he or she will selectively attend to messages that support his or her own position and will show belief perseverance when faced with disconfirming evidence.

These suggestions should be taken into account when conducting interventions that aim to increase knowledge about breast cancer risk factors and change women's perceptions of their risk of developing the disease. These suggestions also help to explain why educational interventions may not be successful in increasing some women's knowledge regarding breast cancer risk factors and changing preexisting belief systems. Health educators should assess for possible preexisting biases that may affect women's open-mindedness to health messages.

Methods

Recruitment and Procedures

Assessing knowledge of breast cancer risk factors was a secondary aim of a community-based survey that examined perceived breast cancer risk and the relationship between subjective and objective risk estimates. Details about recruitment methods and study procedures have been reported elsewhere (Katapodi, Dodd, Lee, Facione, & Cooper, 2004). This study recruited a convenience sample of women, aged 30–85, who never had been diagnosed with cancer and agreed to complete a questionnaire in English. Women with a prior diagnosis of any type of cancer were excluded from the survey. Recruitment was conducted by posting flyers on bulletin boards in community settings in the San Francisco Bay Area, such as churches, senior centers, coffee shops, public libraries, and workplaces, and through a newspaper advertisement. Women responded by calling a dedicated telephone number and expressing their interest in participating in the study. Participants completed an anonymous questionnaire and were paid $15. According to the study protocol, which was approved by the University of California, San Francisco, Committee of Human Rights, participants signed an informed consent before completing the questionnaire. Data collection occurred over a period of 13 months, from February 2003–March 2004.

Measurements

Age, race or culture, education, income, employment status, health insurance status, and marital status were assessed with single-item questions from the Behavioral Risk Factor Surveillance System (Centers for Disease Control and Prevention, 2002). Women's family history of breast cancer was assessed by asking them to indicate the number of their first- and second-degree relatives who had been affected by the disease. Women were categorized into one of four groups: no family history, one or more affected second-degree relatives, one affected first-degree relative, and multiple affected family members (i.e., more than one first-degree relative or one first-degree and one second-degree relative) ("Statement of the American Society of Clinical Oncology," 1996). Breast cancer risk factors used by the Gail model (Gail et al., 1989), such as age at first menstrual period, age at first live birth, and the number of breast biopsies, also were assessed.

Participants indicated whether 13 situations might be risk factors for breast cancer. The researchers defined women's knowledge of breast cancer risk factors as the total number of situations recognized that increased the probability of developing the disease. Five of these items described risk factors identified by the Gail model (Royak-Schaler et al., 2002). The remaining eight items were based on current literature and examined knowledge of hereditary and familial risk factors for breast cancer. Women could respond "yes," "no," or "don't know" to each item. According to the theoretical framework of the study, women who responded "don't know" to a particular item would be more open-minded to acknowledging that item as a risk factor, compared to women who responded "no" to the same item. Items that

were answered affirmatively were summed to calculate each woman's score for knowledge of breast cancer risk factors and to create the **Breast Cancer Risk Factor Knowledge Index (BCRFKI),** with scores ranging from 0–13. These 13 items were highly intercorrelated (Cronbach's $\alpha = 0.80$). Psychometric theory suggests that lists of items, such as a list that examines knowledge of risk factors, should be treated as indexes and have reliability assessed by test-retest (Streiner, 2003). However, the cross-sectional study design did not allow for examination of the test-retest reliability of the BCRFKI.

Statistical Analysis

Data were analyzed using the SPSS® 11.5 (SPSS Inc., Chicago, IL) statistical program. For all statistical analyses, significance was set at the 0.05 level with 95% confidence intervals. Bivariate analysis, such as Pearson correlations (r), and F tests with Bonferoni post-hoc contrasts were used to examine significant demographic differences among women in the sample. Simultaneous multiple regression analysis and binary logistic regression analysis were used to identify factors associated with knowledge of breast cancer risk factors (Cohen & Cohen, 1983).

Results

In total, 184 women were recruited ($\bar{X}$ age $= 47 \pm 12$ years; range $= 30-85$). Forty-three percent identified themselves as non-Hispanic and of European descent, 27% as non-Hispanic and of African descent, 16% as Asian descent, and 14% as Hispanic descent. Ten participants (6%) were of Ashkenazi Jewish descent. Many women (49%) had attended four or more years of college, but 8% had not completed high school. The median annual income was less than $40,000, with 21% of the sample reporting an annual income of less than $10,000 and 12% reporting an annual income of more than $70,000. More than half of the women (55%) were employed outside of the home, and 77% had health insurance. Only 33% were married or a member of an unmarried couple (see Table 1). Although the sample was comparable to the San Francisco Bay Area population, it included an overrepresentation of non-Hispanic women of African descent and women with a college education ("San Francisco Bay Area Census," 2000).

Approximately two-thirds (64%) of the participants did not have a family history of breast cancer. Twenty-four women (14%) had one or more affected second-degree relatives, 18 women (10%) had one affected first-degree relative, and 16 women (9%) had multiple affected relatives. Approximately one in five women had her first menstrual period before age 12 (21%) or had undergone one or more breast biopsies (18%), and 18 women (10%) had their first baby after age 30 (see Table 2).

No significant differences were found among women of different races or cultures in regard to mean age and family history of breast cancer. Women of European descent were more likely to have more education than women of African descent and Hispanic women, and women of Asian descent were more likely to be more educated than women of African descent but not Hispanic women (F[3, 180] = 15.86, p < 0.001). Women of Asian descent were more likely to report higher incomes than women of other racial or cultural

Table 1. Demographic Characteristics of the Sample

Variable	n	%
Age (years)		
$\bar{X} = 47 \pm 12$	–	–
Range = 30–85	–	–
30–39	63	34
40–49	51	28
50–69	54	29
70–85	10	5
Not available	6	3
Race or culture		
Non-Hispanic European descent	69	37
• Ashkenazi Jewish descent	10	6
Non-Hispanic African descent	50	27
Hispanic	25	14
Asian descent	30	16
Education		
Elementary school (grades 1–8)	7	4
Some high school (grades 9–11)	8	4
High school graduate (grade 12, GED)	31	17
Some college or technical school (1–3 years)	48	26
College graduate (more than 4 years)	90	49
Annual family income ($)		
Less than 10,000	39	21
10,000–30,000	49	27
30,000–50,000	45	24
50,000–70,000	22	12
More than 70,000	21	12
Not available	8	4
Employment status		
Full-time	102	55
Unemployed, employed part-time, retired, student	80	44
Not available	2	1
Health insurance		
Yes	142	77
No	38	21
Not available	4	2
Marital status		
Married	45	25
Divorced	30	16
Widowed	17	9
Separated	7	4
Never married	69	38
Member of an unmarried couple	15	8
Not available	1	1

N = 184

backgrounds (F[3, 172] = 6.90, p < 0.001). Education was significantly correlated with income for women of African descent only (r = 0.50, p = 0.001).

Knowledge of Breast Cancer Risk Factors

Table 3 presents participants' responses on the BCRFKI. Approximately 75% recognized that multiple affected family members, a maternal family history of breast cancer, and a previous breast cancer diagnosis are risk factors. Surprisingly, only 45% recognized that a positive paternal family history is a risk factor, whereas 28% responded "don't know" to this item. Similarly, 42% responded affirmatively that having a genetic mutation is a risk factor, whereas 30% responded "don't know." Approximately 70% recognized that a family member with both breast and ovarian cancer is a risk factor, but only 41% recognized that a family history of ovarian cancer could

Table 2. Breast Cancer Risk Factors Within the Sample

Variable	n	%
Family history of breast cancer		
No family history	117	64
One or more affected second-degree relatives	24	14
One affected first-degree relative	18	10
Multiple affected relatives[a]	16	9
Not available	9	4
Age at first menstrual period		
Younger than 12	38	21
12–13	84	46
14 or older	56	30
Not available	6	3
Age at first live birth		
Nulliparous	87	47
Younger than 20	30	16
20–24	30	16
25–29	19	11
30 or older	18	10
History of breast biopsy		
None	150	82
One	25	14
More than one	9	4

N = 184

[a] More than one first-degree relative or one first-degree relative and one or more second-degree relatives

Note. Because of rounding, not all percentages total 100.

be a risk factor. Fewer women, 10% and 34%, respectively, responded "don't know" to these items.

Aging was recognized as a risk factor by 57% of the women in the study, whereas 23% and 15% responded "no" and "don't know" respectively. Half of the women (50%) thought that a previous breast biopsy was not a risk factor, and 17% responded "don't know." Similarly, 41% recognized that older age at first live birth is a risk factor, and 28% responded "don't know." Forty-nine and fifty-seven percent

of women responded that they did not know whether delayed onset of menopause or being of Ashkenazi Jewish descent were breast cancer risk factors, respectively.

Characteristics Associated With Knowledge of Breast Cancer Risk Factors

Most participants correctly identified between six and eight risk factors ($\overline{X} = 6 \pm 3$; range = 0–13). A simultaneous multiple regression was performed. The dependent variable was the total score on the BCRFKI, which represented knowledge of hereditary, familial, and sporadic breast cancer risk factors. The independent variables were age, education, income, race or culture, Ashkenazi Jewish descent, family history of breast cancer, age at first live birth, age at first menstrual period, and number of breast biopsies. Race or culture, family history of breast cancer, and age at first period were entered in the regression model as dummy-coded variables. Most women (n = 172) had complete responses and were included in the analysis. The overall model predicted the variance of the BCRFKI to be approximately 22% ($R^2 = 0.224$, $\Delta F = 3.51$, $p < 0.001$). Characteristics significantly associated with a higher score on the BCRFKI were education, one or more affected second-degree relatives, and being of Ashkenazi Jewish descent (see Table 4). A logistic regression analysis was performed using the item "getting older" as a dichotomous (i.e., yes or no) criterion variable and the age of the participants as the predictor variable. Interestingly, as the age of participants increased, the probability of recognizing "getting older" as a risk factor for breast cancer decreased (n = 168, B = –0.037, SE = 0.014, Wald $\chi^2 = 7.408$, df = 1, p = 0.006, Exp(B) = 0.963, 95% confidence interval for Exp(B) = 0.938–0.990).

Discussion

This study examined knowledge of sporadic, hereditary, and familial breast cancer risk factors and characteristics associated with that knowledge in a multicultural sample. Participants were recruited from community settings they

Table 3. Knowledge of Breast Cancer Risk Factors

Type of Breast Cancer	Risk Factor	Yes n	Yes %	No n	No %	Don't Know n	Don't Know %	Not Available n	Not Available %
Hereditary or familial	Multiple family members with breast cancer	140	76	24	13	10	5	10	5
	Family history of breast cancer from the mother's side of the family	138	75	23	13	10	5	10	5
					21				
	Having had breast cancer before	131	71	39		4	2	10	5
	Family member with both breast and ovarian cancer	127	69	27	15	18	10	12	7
	Family history of breast cancer from the father's side of the family	82	45	40	22	51	28	11	6
	Having a genetic mutation	78	42	37	20	56	30	13	7
	Family history of ovarian cancer	75	41	35	19	63	34	11	6
	Being of Ashkenazi Jewish descent	14	8	53	29	104	57	13	7
Sporadic	Getting older	104	57	42	23	28	15	10	5
	Late age at first pregnancy	75	41	47	26	52	28	10	5
	Early start of menstruation	52	28	60	33	59	32	13	7
	Having had a breast biopsy	50	27	92	50	31	17	11	6
	Late start of menopause	22	12	58	32	90	49	14	8

N = 184

Table 4. Predictors of Knowledge of Breast Cancer Risk Factors

Variable	B	SEB	β
Age	0.005	0.021	0.018
Education	0.873	0.274	0.279*
Asian descent versus European descent (dummy variable)	−0.953	0.752	−0.108
African descent versus European descent (dummy variable)	−0.520	0.653	−0.072
Hispanic versus European descent (dummy variable)	0.205	0.783	0.022
First menstrual period before age 12 versus age 12–13	−0.310	0.300	−0.081
First menstrual period after age 14 versus age 12–13	−0.207	0.262	−0.062
Age at first live birth	−0.052	0.020	−0.211
Number of breast biopsies	0.563	0.328	0.129
Ashkenazi Jewish descent	−2.119	1.062	−0.151*
Second-degree relatives versus no family history (dummy variable)	0.858	0.630	0.106*
First-degree relatives versus no family history (dummy variable)	1.522	1.086	0.105
Multiple family members versus no family history (dummy variable)	0.155	0.809	0.014

*$p < 0.05$

were likely to visit within the context of their everyday lives, such as coffee shops, senior centers, and workplaces.

Despite the general awareness of the role of family history in breast cancer susceptibility, 20% of participants lacked important understanding regarding the impact of family history on the risk of developing the disease. Consistent with other studies (Grande, Hyland, Walter, & Kinmonth, 2002; Mouchawar, Byers, Cutter, Dignan, & Michael, 1999), most participants (76%) recognized that having multiple affected family members is an important risk factor. However, women were more likely to recognize maternal family history as a risk factor (75%), whereas significantly fewer (45%) recognized paternal family history as an independent risk factor. A community-based study (Vuckovic, Harris, Valanis, & Stewart, 2003) and a study that recruited patients with early-onset breast cancer (Miesfeldt, Cohn, Ropka, & Jones, 2001) suggested that many women are unsure of how and from whom breast cancer risk can be inherited. Those women are significantly more likely to underestimate their breast cancer risk if affected family members are on the father's side.

Women at risk for hereditary breast cancer also are at risk for ovarian cancer and vice versa. Although most women (69%) recognized that a family history of breast and ovarian cancer is a risk factor, only 41% recognized that a family history of ovarian cancer might increase one's risk for hereditary breast cancer. Some participants possibly did not recognize that the etiology of hereditary breast cancer could be related closely to that of ovarian cancer. Andersen, Bowen, Yasui, and McTiernan (2003) reported that 75% of women at high risk for hereditary breast and ovarian cancer did not know that they were at increased risk for ovarian cancer and did not use existing screening methods for early detection of the disease. Women in this risk group are more likely to underestimate their breast cancer risk if they are not aware of the connection between breast and ovarian cancer.

A significant number of women (38%) did not recognize aging as a risk factor for breast cancer. The older the participant, the less likely she was to recognize age as a risk factor for breast cancer. This finding was surprising because age is a well-established risk factor for sporadic breast cancer. Apparently, however, women do not always understand and integrate this information. Strecker, Williams, Bondy, Johnston, and Northrup (2002) reported that 35% of healthcare providers and

45% of laywomen did not recognize age as a breast cancer risk factor after receiving extensive education on the subject. Other studies have suggested that some women lack basic knowledge about breast cancer risk factors (Absetz, Aro, Rehnberg, & Sutton, 2000) and create mental images of a stereotypical person who is likely to be affected by the disease (Katapodi, Facione, Humphreys, & Dodd, 2005). These findings suggest that when women lack the specific knowledge that getting older increases the risk for developing breast cancer, they are more likely to believe that the disease affects mostly younger women.

Age and family history are independent predictors of sporadic, hereditary, and familial forms of breast cancer. Interactions between these two risk factors are complicated and difficult to interpret in clinical practice. Strecker et al. (2002) reported that the differences between sporadic and inherited predisposition to breast cancer were the most difficult to understand both by laywomen and healthcare providers. Women carrying genetic mutations associated with hereditary breast cancer have an increased risk of early onset of the disease that is reduced to an average level as they age. Similarly, the diagnosis of a second-degree relative with breast cancer does not significantly increase a woman's risk for the disease unless it occurs at an early onset, which might signify hereditary or familial breast cancer. These cases differ strikingly from sporadic breast cancer, which poses a greater risk as women age.

Situations that increase women's risk for sporadic breast cancer, such as early age at menarche, late age at menopause, late age at first live birth, and having one or more breast biopsies, were less acknowledged as breast cancer risk factors by participants in the study. These risk factors are related to breast cancer etiology, possibly because women's breast tissue before pregnancy is more sensitive to carcinogens than breast tissue that has gone through its complete hormonal development (American Cancer Society, 2005). An average of only one in three women responded affirmatively that these items were risk factors, whereas approximately 65% were unsure of their implications. In contrast, studies have reported that women most often estimate their breast cancer risk based on factors whose role in breast cancer etiology remain to be established, such as smoking (Aiken, Fenaughty, West, Johnson, & Luckett, 1995; Silverman et al., 2001). These findings suggest a gap in knowledge of breast cancer risk factors.

Education levels were significantly associated with knowledge of breast cancer risk factors. Despite the fact that 49% of the study participants had completed four or more years of college and an additional 26% had completed some college or a technical school, their knowledge of breast cancer risk factors was incomplete. Women also displayed an incomplete knowledge of risk factors regardless of their race or culture. Studies suggested that racial or cultural differences affect decision making regarding genetic testing among women of African descent (Hughes, Fasaye, LaSalle, & Finch, 2003). The data from this study showed that education was the strongest recorded predictor of a high score on the BCRFKI and suggested the possibility that education and race or culture should be examined together as predictors of knowledge of breast cancer risk factors. The finding that only 42% of women recognized a genetic mutation as a breast cancer risk factor most likely reflects that women do not understand the meaning of "genetic mutation." Roche et al. (1998) suggested that women often do not understand the meaning of terms and phrases commonly used by healthcare professionals.

Having one or more affected second-degree relatives was significantly associated with a high score on the BCRFKI, whereas the associations between BCRFKI scores and having one affected first-degree relative or multiple affected family members were not significant. Several explanations are possible for these findings. Family history with one affected first-degree relative or multiple affected relatives may not have reached statistical significance because of the small number of women in the sample with those conditions. Alternatively, some women underestimate the importance of having one affected first-degree relative as a risk factor (Absetz et al., 2000; Aiken et al., 1995), whereas women with multiple affected family members concentrate on the importance of genetic risk factors. Of concern in such scenarios is the underestimation of the importance of other factors that increase the probability of sporadic breast cancer. Future studies in which larger samples are stratified according to family history of breast cancer may address this issue.

Limitations

The limitations of this study should be considered to properly temper any conclusions drawn. The results were based on a convenience sample of self-selected women, and the assessment of risk factors was based on self-report. Although knowledge of important breast cancer risk factors was examined, the list was not exhaustive. Breast cancer risk factors that were not examined include alcohol consumption, obesity, Caucasian ethnicity, and postmenopausal use of hormone therapy. In addition, whether women knew that early onset is indicative of hereditary disease or about the possibility of an association between breast cancer and other forms of cancer were not examined. However, the latter seem unlikely to be of further use because of the strong likelihood that knowledge of risk related to technical genetic terminology is lacking in the general population. The cross-sectional nature of the study did not allow examination of the test-retest reliability of the BCRFKI, which may have implications for the validity of the measure. Despite these limitations, the strengths of the study include its recruitment of women from diverse socioeconomic and racial and cultural backgrounds and from community settings, which ensured that participation was not limited only to women who have greater access to healthcare services and therefore to greater access to educational material related to breast cancer risk factors.

Implications for Nursing

Nursing has offered compelling examples of educational and counseling interventions targeting high risk (Snyder et al., 2003) and medically underserved women (Lane, Martin, Uhler, & Workman, 2003) recruited from the community. Until similar programs become widely available and accessible, women in the community must depend on primary care providers for risk assessment, counseling, and education about breast cancer risk factors. Advanced practice nurses (APNs) can incorporate the calculation of a woman's risk for breast cancer and the probability that she is a carrier of a genetic mutation into routine care by using an appropriate risk assessment model (Rubinstein, O'Neill, Peters, Rittmeyer, & Stadler, 2002). Obtaining a family history and calculating an individual's risk for the disease are time consuming and not commonly practiced; however, an increasing need does exist for redirecting efforts toward personalized breast cancer risk analysis and individually tailored breast cancer screening recommendations (Strecker et al., 2002). Unless APNs obtain an adequate family history and information about breast cancer risk factors, they may not recognize clients at increased risk for the disease or for hereditary cancer syndromes. APNs can apply recent advances in cancer genetics to improve the care and education of their clients by informing women about the mechanisms of sporadic, hereditary, and familial cancer in terms of clients' level of risk. A helpful first step in defining family history might be clarifying which types of cancer, the age at onset of cancer, and the degree of relatedness of family members of both genders with the disease (McKelvey & Evans, 2003).

Finding the most effective ways to educate individuals regarding their risk for sporadic, hereditary, and familial disease is not an easy task. As suggested by the theoretical framework of the study, educational interventions should assess preexisting knowledge and personal experiences that predispose individuals to biased information processing. Women who respond "no" to a particular item may be less open-minded to accepting that situation as a risk factor compared to women who respond "don't know." For instance, more women in this study believed that having breast cancer once before and having one or more breast biopsies were not breast cancer risk factors, compared to women who responded "don't know" to these items. More effort and a different approach may be needed to persuade the first group of women that these two situations increase a woman's risk for the disease. Future studies should investigate the best way to examine open-mindedness, biased information processing, and readiness to learn. In addition, future studies should examine other factors that influence the outcome of educational interventions, such as cultural factors that influence genetic counselors' attitudes toward preventive measures (Bouchard et al., 2004) and the optimum amount of information that should be given to clients seeking genetic consultation (Lobb et al., 2004). As the field of cancer risk assessment continues to grow, educational materials should evolve to meet the knowledge needs of healthcare providers and women in the community.

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Underestimation of breast cancer risk: Influence on screening behavior

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Underestimation Of Breast Cancer Risk: Influence On Screening Behavior

Abstract

Purpose/Objectives: The study 1) described perceived breast cancer risk, 2) identified the percentage of women with inaccurate perceptions of risk and 3) examined the influence of perceived and objective risk on screening behavior.

Design: Descriptive, correlational, cross-sectional.

Setting: Community settings in a major, west coast metropolitan area.

Sample: A multicultural sample (57% non-white) of 184 English-speaking women (mean age 47±12, range 30-84), who have never been diagnosed with any type of cancer.

Methods: The survey used two Perceived Risk scales (Verbal & Comparative) and the Gail model to assess perceived and objective breast cancer risk respectively.

Main Research Variables: Perceived breast cancer risk, objective breast cancer risk obtained from the Gail model, screening behavior.

Findings: Participants reported that they "Probably Not" get breast cancer, and that their risk was "Somewhat Lower" than average. Family history of breast cancer was a significant predictor of perceived breast cancer risk (sr^2=0.052 and sr^2= 0.043, $p<0.05$, in the Verbal and Comparative scales respectively). Demographic characteristics and objective risk factors from the Gail model were not associated with perceived risk. Most (89%) high-risk women underestimated their actual risk; fewer (9%) low/average risk women overestimated their risk. Age, Gail scores and health insurance promote breast cancer screening; underestimation of risk had the opposite effect.

Conclusions: Perceived risk is an important predictor of screening behavior in many theoretical frameworks. Inaccurate perceptions of risk do not promote optimal breast cancer screening; this has implications for the majority of high-risk women who underestimated their risk.

Word count: 246

Key Points

1. Little progress has been made to educate community women about the importance of reproductive history in breast carcinogenesis.

2. Approximately 15% of community-dwelling women are at higher- than-average risk for developing breast cancer. These women might benefit from informed decision-making regarding breast cancer chemoprevention and individualized recommendations for early detection.

3. The majority of high-risk women underestimate their breast cancer risk. The latter does not promote the adoption of screening practices at an appropriate level of risk.

Introduction

Breast cancer is the second leading cause of cancer death for women in the United States. Epidemiology, molecular biology, and genetics have improved our understanding of disease etiology, while early detection decreases morbidity and mortality (American Cancer Society, 2008). The Gail model is a breast cancer risk assessment tool that uses epidemiological and reproductive history variables to provide an objective estimate of the probability of developing the disease (Gail et al., 1989; Gail & Constantino, 2001). Healthcare providers can use the Gail model to obtain an objective estimate of a woman's breast cancer risk and

subsequently, provide tailored education about risk factors, 5-year and lifetime probability of developing the disease, and tailored recommendations for screening. Women at average/population risk should obtain Clinical Breast Exams (CBEs) and annual mammograms starting at the age of 40 years (American Cancer Society, 2008), whereas, high-risk women could explore additional screening methods and might consider initiating screening at an earlier age and/or at more frequent intervals (Gail & Rimer, 1998; Humphrey, Helfand, Chan, & Woolf, 2002). Supposedly, a woman who has received individualized information about her breast cancer risk will maintain an appropriate level of health-protective behaviors (Leventhal, Kelly, & Leventhal, 1999; Weinstein & Nicolich, 1993).

Two meta-analyses supported that perceived breast cancer risk has a significant positive effect on screening mammography (Katapodi, Lee, Facione, & Dodd, 2004; McCaul, Branstetter, Glasgow, & Schroeder, 1996). However, the reported effect sizes were small (g=+0.20 and g=+0.16, (Katapodi et al., 2004; McCaul et al., 1996) respectively), which suggests that perceived risk may not be the primary force behind breast cancer screening.

One possible explanation for the observed small effect sizes is that perceptions of risk that err on the side of underestimation possibly inhibit the adoption of screening mammography at a level that is appropriate for each woman's actual level of risk. This suggestion has significant clinical implications. On one hand, high-risk women who underestimate their risk are less likely to adhere to medical recommendations and benefit from advances in early detection and (chemo-)prevention of breast cancer. On the other hand, low/average risk women who overestimate their risk are likely to suffer unnecessary anxiety.

Consequently, it would be informative to examine the accuracy of women's perceived

breast cancer risk and the influence of perceived risk on breast cancer screening. The specific

aims of the study were to 1) describe women's perceived breast cancer risk, 2) describe the

objective risk of the sample and identify the percentage of women that have an inaccurate

perception of their actual risk, and 3) examine the influence of objective and perceived risk on

breast cancer screening, namely screening mammograms, CBEs, and Breast Self Exams (BSEs).

Theoretical Framework and Background

Perceived risk to a health problem refers to a risk judgment about the probability of the

health problem to be experienced. Several theoretical frameworks that aim to explain and

predict health-related behaviors concur that perceived risk is a major force behind adopting

health-protective behaviors. The Precaution Adoption Process (Weinstein, 1988) suggests that

hearing general information about a health problem from the media, acquaintances, and

health-related sources increases awareness about the health problem, but does not establish

who is likely to be affected. Most individuals hold an optimistic bias, meaning that they

underestimate their actual risk and/or perceive that they are less likely than others to be

affected. Acknowledging personal risk occurs when people receive education about personal

risk factors, have a close experience with the health problem, or receive information about the

risk status and protective behaviors of their peers (Weinstein & Klein, 1995). People who

perceive that they are at higher risk would be more likely to take appropriate actions to reduce

their risk, which should result in a positive correlation between perceived risk and adoption of

precautions (Weinstein & Nicolich, 1993).

Research has widely replicated phenomena of optimistic bias, which means that people systematically believe that they are better than others in various ways, or that they are less likely than others to encounter life's negative events (Alicke, Klotz, Breitenbecher, Yurak, & Vredenburg, 1995; Messick, Bloom, Boldizar, & Samuelson, 1985; Svenson, 1981). However, studies that examined perceived breast cancer risk report conflicting findings. Some studies reported that the majority of women do not take into account factual information when estimating their breast cancer risk (Daly et al., 1996; Katapodi et al., 2004). When asked to compare the risk of getting breast cancer to the risk of their friends/peers, or to the risk of a same age woman they significantly underestimated their personal risk (Absetz, Aro, Rehnberg, & Sutton, 2000; Aiken, Fenaughty, West, Johnson, & Luckett, 1995; Clarke, Lovegrove, Williams, & Machperson, 2000; Facione, 2002; McDonald, Thorne, Pearson, & Adams-Campbell, 1999). In addition, when comparing subjective risk estimates to objective risk estimates obtained from the Gail model, a large percentage of women recruited from regional and national databases significantly underestimated their risk (Haas et al., 2005; Sabatino et al., 2004). These findings are consistent with suggestions of the precaution adoption process. However, a significant number of studies that compared perceived risk to Gail risk estimates reported that most women overestimate their breast cancer risk (Buxton et al., 2003; Daly et al., 1996; Davids, Schapira, McAuliffe, & Nattinger, 2004; Dolan, Lee, & McGrae-McDermott, 1997; Metcalfe & Narod, 2002).

These conflicting findings have been partially attributed to the confounding effects of recruitment site and measurement scale (Katapodi et al., 2004). On one hand, recruitment from health care settings or through an affected relative probably produces samples that have

greater access to care or a recent and vivid experience with the disease. Therefore, a community-based sample might provide a more representative account of women's subjective breast cancer risk estimates. On the other hand, numerical measures of perceived risk fail to capture the intuitive interpretation of probability assessments. The intuitive meaning assigned to the numerical probability (high/low) depends on a comparison assessment of the numerical probability against a qualitative, intuitive standard (Teigen & Brun, 2000; Windschitl, Martin, & Flugstad, 2002). The comparison standard could be either the individual's perceived standing on relevant risk factors or the perceived risk status of peers (Kahneman & Miller, 1986; Weinstein, 1984).

The present study attempted to address the issues mentioned above by examining the absolute and comparative perceived breast cancer risk of a community-dwelling sample. The study examined the percentage of women that have an inaccurate perception of their risk, and whether underestimation of risk interferes with optimal breast cancer screening.

Methods

Recruitment and Procedures

The study recruited a community sample from a west coast metropolitan area. Advertisements were placed in local newspapers and newspapers targeting ethnic minority groups. Flyers were posted on bulleting boards of places that women were likely to visit in their daily living, such as workplaces, senior, religious, and cultural centers, libraries, restaurants, coffee shops, and homeless shelters.

Women were eligible to participate if they were between the ages of 30 and 85, had never been diagnosed with any type of cancer, and were willing to complete a questionnaire in

English. The minimum age limit of 30 years was chosen because some aggressive types of breast cancer occur in women in their thirties (American Cancer Society, 2008). The maximum age limit was set at 85 years according to the Gail model (Gail et al., 1989). Women with a prior diagnosis of any type of cancer were excluded from the study because they would be more likely to have received extensive education about their cancer risk and risk factors.

Potential participants responded by calling a dedicated telephone number and expressing their interest in the study. Eligibility was determined by the first author based on women's reports. Two hundred and three women called and expressed their interest in the study. However, 19 were excluded – three had a previous cancer diagnosis, 12 were younger than 30 years of age, and four decided that they were not interested in the study – leaving a final sample of N=184 women. Participants completed the survey in a place and time of their choice and were paid $15. The study protocol was approved by the ethics committee of a major research institution and the IRB of the funding agent.

Measurements

Perceived Breast Cancer Risk was measured with a Verbal and a Comparative scale. The scales were introduced in different sections of the questionnaire and the former preceded the latter. The Verbal scale asked: *"What do you think are the chances that you will develop breast cancer in your lifetime? On a scale from 0 (Definitely will NOT) to 10 (Definitely will) please circle one number that best describes your answer."* In order to provide women with appropriate context and avoid misinterpretation that has been reported elsewhere (Woloshin, Schwartz, Black, & Welch, 1999), the numbers were coupled with five verbal anchors; '0' and '1' were coupled with "Definitely Will Not", '2' and '3' with "Probably Will Not", '4', '5', and '6' with

"Fifty-fifty", '7' and '8' with "Probably Will", '9' and '10' with "Definitely Will." Approximately

10% of participants marked a point between two numbers or marked a verbal anchor instead of

circling a number. For those cases we took a conservative approach and we used the

corresponding number closest to the center of the scale.

The Comparative scale asked: *"Compare yourself with other women your age, like your*

friends or your peers. What are your chances of getting breast cancer in your lifetime?"

Participants used a five-point scale ranging from '1' "A Lot Lower" to '5' "A Lot Higher."

Both the Verbal and Comparative scales have been used by other investigators to assess

perceived breast cancer risk (Gurmankin-Levy, Williams, Quistberg, & Armstrong, 2006). The

Verbal scale had low sensitivity (0.37) but high specificity (0.93) in identifying women with very

high perceived risk, and high sensitivity (0.81) and specificity (0.93) in identifying women with

very low perceived breast cancer risk. The Comparative scale had high sensitivity (0.90) and

specificity (0.99) in identifying women with very high perceived risk, and high sensitivity (0.89)

and specificity (0.91) in identifying women with very low perceived breast cancer risk.

Objective Breast Cancer Risk was calculated with the Gail model; we calculated a *five-*

year and a *lifetime Gail* score with the online version of the Breast Cancer Risk Assessment Tool

(BCRAT) (National Cancer Institute, 2002). The Gail model assesses age, number of affected

First-Degree Relatives (FDRs) (mother, sister), number of breast biopsies, and reproductive

history (age of menarche, age of first live birth) (Gail et al., 1989). According to

recommendations from the American Society of Clinical Oncology (ASCO, 1996), we also asked

participants to indicate the number of affected Second Degree Relatives (SDRs) (grandmother,

aunt, uncle). However, the latter information is not included in the Gail model.

Breast Cancer Screening and demographics was assessed with a series of questions used

in the 2001 survey of the Behavioral Risk Factors Surveillance System (CDC, 2002). Participants

were asked *how long* it has been since their *last mammogram* and their *last CBE*. Based on

these questions two variables were created to assess frequency of mammogram and frequency

of CBE. In both questions answers ranged from *"0" Never, "1"Within the past year - less than*

12 months ago to *"5" 5 or more years ago*. We also asked participants *how often* they perform

BSE; answers ranged from *"0" Never, "1" Rarely* to *"4" Very often (more than monthly)*.

Statistical Analyses

Data were analyzed using SPSS 14®. We calculated individual scores when at least 60%

of items were completed. Risk scales, 5-year and lifetime Gail scores, and frequency of

screening were treated as continuous variables. We used regression analyses to identify

predictors of perceived breast cancer risk and bivariate analyses (Pearson correlation

coefficient) to examine the influence of perceived and objective breast cancer risk on screening

behaviors. Collinearity diagnostics was assessed with the Variance Inflation Factor (V.I.F.),

which was lower than 1.5 in all models. The goodness of fit for each linear regression model

was assessed using the model effect size (R^2) and ANOVA (F) tests. The unique contribution of

each predictor after controlling for other predictors was assessed with the squared partial

correlation (sr^2). Power analysis indicated that a sample of N=147 would provide Power=0.80

to detect moderate correlations among predictive variables (R^2 =0.13) with alpha=0.05.

Results

The sample included 184 women (mean age = 47±12 years, Range: 30-84); more than

half (57%) self-identified as non-white. Approximately half of these women (49%) had attended

four or more years of college but 8% had not completed high school. Most (77%) had health

insurance. The median annual household income was between $30,000 and $40,000, with

approximately one in five women (22%) reporting an income of <$10,000. The majority of

participants (64%) did not have a family history of breast cancer (Table 1). (Insert Table 1).

Perceived Breast Cancer Risk

On the Verbal scale participants responded that they would *"Probably Not"* get breast

cancer (mean: 3.58±1.70, range: 0 to 8). Eighteen participants (12%) reported that they

"Definitely Will Not" get breast cancer" (responded '0' or '1'), while 8 participants (4%)

reported that they "Probably Will" get the disease (responded '7' or '8').

On the Comparative scale participants responded that their risk was *"Somewhat Lower"*

than the risk of an average, same age woman (mean: 2.63±0.88, range: 1 to 5). Sixty

participants (33%) rated their risk as "A Lot Lower" or "Somewhat Lower" (responded '1' or '2'),

while 19 participants (10%) rated their risk as "Somewhat Higher" or "A Lot Higher" (responded

'4' or '5').

Two regression analyses were used to examine whether demographic characteristics

and objective risk factors from the Gail model were associated with perceived breast cancer

risk. Education, income, race/culture, age, age at first menstrual period, age at first live birth,

number of breast biopsies, number of affected FDRs, and number of affected SDRs were the

predictor variables, while the Verbal and Comparative risk scales were the dependent variables.

The models were significant (p=0.017 and p<0.001 respectively) and family history of breast

cancer was a common predictor of perceived breast cancer risk (Table 2). (Insert Table 2).

Accurate and inaccurate perceptions of breast cancer risk

The mean lifetime Gail score for participant women was 10.24($\pm$6.05) (median=9.7, range: 2.2 to 39.3). Most participants (77%) had a lifetime Gail score below the population average score of 12.3% (American Cancer Society, 2008). Clinical data suggest that women with a 5-year Gail risk score above 1.67% are high-risk, and they might want to consider breast cancer chemoprevention with tamoxifen or raloxifen (Chlebowski et al., 2002; Cummings et al., 1999; Fisher et al., 1998; Reddy & Chow, 2000). Consequently, we used the 5-year Gail score as a way of identifying high-risk women in the sample. The mean 5-year Gail score of the sample was 0.95($\pm$0.80) (median=0.7, range: 0.1 to 5.0). Most participants (85%) had a low 5-year Gail risk ($\leq$1.67%), while 25 women (15%) had a high five-year Gail score (> 1.67%).

We examined the percentage of high-risk women that perceived their breast cancer risk to be low/average ($\leq$6 on the Verbal scale and $\leq$3 on the Comparative scale), or high (>6 on the Verbal scale and >3 on the Comparative scale). The majority of the 25 high-risk women (5-year Gail score >1.67%) had inaccurate perceptions of their risk. At best, some of these high-risk women believed that their risk is the same as the risk of the overall population. Fewer low/average risk women overestimated their breast cancer risk (Tables 3 and 4). (Insert Tables 3 and 4).

Influence of perceived and objective breast cancer risk on screening behavior

Frequency of screening mammograms was assessed only for women who were older than 40 years of age (N=115, range: 40-84, Mean Age = 53$\pm$9). Most of these women (74%) reported having a screening mammogram less than two years ago. Frequency of CBE and BSE was assessed for all women in the sample (N=184). Most women (54%) reported having a CBE less than 12 months ago; 16% reported that it had been more than two years since their last

CBE. Most participants (76%) reported performing a BSE at best, every other month. (Table 5).

(Insert Table 5).

There was no correlation among measures of perceived breast cancer risk and screening

behavior (Table 6). Women with health insurance and with higher 5-year Gail scores were

more likely to have received a recent screening mammogram.   (Insert Table 6).

Discussion

The study described absolute and comparative assessments of breast cancer risk,

examined the influence of demographic characteristics and objective risk factors on perceived

risk and the percentage of women that have an inaccurate perception of their risk, and

described the correlations among objective risk, perceived risk, and breast cancer screening.

Women in the study believed that they are not likely to get breast cancer in their

lifetime and that their breast cancer risk is lower than the risk of average, same age women.

This is consistent with findings of other studies (Aiken et al., 1995; Clarke et al., 2000; Facione,

2002; Lipkus et al., 2000; McDonald et al., 1999). Measuring perceived risk with the ideal

probability scale has been a challenge for researchers (Diefenbach, Weinstein, & O'Reilly, 1993).

In the present study, within-method triangulation with two probability scales that used verbal

descriptors allowed us to neutralize the contextual, wording, and anchoring limitations of each

scale. Future studies should consider using research methodologies that allow a more

comprehensive approach in exploring complex phenomena related to health behaviors.

According to Weinstein (Weinstein, 1987), optimistic bias is not influenced by

sociodemographic characteristics. However, research suggests that older women are less likely

to perceive that they are at risk for breast cancer, while women with higher education are more

likely to perceive a higher risk (Katapodi et al., 2004; McQueen, Swank, Bastian, & Vernon, 2008). Both these suggestions were substantiated in the present study; older age was a negative predictor, while higher education was a positive predictor of comparative risk. Educational interventions should target older and low literacy women to correct erroneous perceptions of risk and to emphasize that in most cases breast cancer risk increases with age.

Women at increased risk due to family history are more likely to acknowledge their risk; this finding has been replicated consistently in many studies (Buxton et al., 2003; Davids et al., 2004; Haas et al., 2005; Katapodi et al., 2004; McQueen et al., 2008) including the present study. However, the majority of participants do not recognize risk factors included in the Gail model. This finding has two significant implications. First, although it has been more than a decade since it was reported that the risk factors associated with the Gail model do not predict perceived risk (Daly et al., 1996), little progress has been made to educate community women about the relative contribution of these factors in breast carcinogenesis. Second, high-risk women who do not have a positive family history are less likely to accurately acknowledge their risk and take appropriate health-protective measures. This is consistent with a state-wide sample, where most high-risk women without a family history were less likely to perceive higher risk (Haas et al., 2005). Health professionals should communicate how different risk factors influence the overall probability of developing the disease.

Similar to others (Davids et al., 2004; Haas et al., 2005; Sabatino et al., 2004), we used the 5-year Gail score of 1.67% to classify participants as high or low risk. Only a small proportion (4% to 9%) of low/average risk participants overestimated their breast cancer risk. Others reported that 28% to 82% of low/average risk women overestimated their risk (Buxton

et al., 2003; Davids et al., 2004); however, the latter findings could be influenced by the

population and the type of risk measure. In contrast, the majority of high risk participants (80%

to 96%) underestimated their risk, which is consistent across studies (Haas et al., 2005; Hughes,

Lerman, & Lustbader, 1996). From a clinical point of view it should be a priority to attend to the

high-risk women. Most underestimate their breast cancer risk, while they could benefit from

an informed decision regarding breast cancer chemoprevention. This represents a gap in the

knowledge of community women and an opportunity for improving health care services.

Nevertheless, it is equally important to attend to the low/average risk women who

overestimate their risk to avoid unnecessary anxiety and overuse of health services.

Findings from a nationwide representative sample suggested that one third of the high-

risk women did not receive screening appropriate to their level of risk (Sabatino et al., 2004). In

the present study screening mammography and CBE was high but not optimal; approximately

75% of the women reported having a mammogram and a CBE within the past 2 years. Time

since last mammogram and time since last CBE were largely influenced by access to health care

services (health insurance) and by objective risk (5-year Gail score), which suggests that the

driving force behind these screening behaviors is most likely a health provider

recommendation.

The absence of a significant correlation between perceived risk and screening behavior

undermines the significance of perceived risk as a motivating factor for breast cancer screening.

The Precaution Adoption Process suggests a positive correlation between perceived risk and

behavior. However, most high risk women (for whom we would expect to see the

aforementioned positive correlation) underestimated their actual risk. Although these

correlations were non-significant, findings were towards the hypothesized direction: perceiving a low/average breast cancer risk did not promote screening behavior. This finding provides a possible explanation for the small effect sizes observed in the literature (Katapodi et al., 2004; McCaul et al., 1996; McQueen et al., 2008).

Limitations

Potential limitations of the study are the convenience sample of English-speaking and mostly urban women, and that the calculation of Gail risk estimates and screening behavior was based on self-reports and may not be accurate. The Gail model is the most appropriate tool for general population risk screening (Euhus, Leitch, Huth, & Peters, 2002); yet, it may be limited in its predictive ability, since it does not calculate risk from affected SDRs and does not take into account the age at onset of the disease. Although it has been extensively validated with white women (Constantino et al., 1999), it may underestimate breast cancer risk for black women (Bondy & Newman, 2003). Since 57% of the sample was non-white, the predictive value of the 5-year Gail risk may be limited.

Nursing Implications

The study recruited women from community settings who did not necessarily have access to educational and other breast health services. Although the sample was relatively small (N=184) it included a significant percent of high risk women (15%). This is consistent with a national community-dwelling sample (N=6,410) where 16% of participants had a 5-year Gail risk greater than 1.67% (Sabatino et al., 2004). These high-risk, community-dwelling women could benefit from informed decision-making regarding additional screening methods, initiating screening at an earlier age and/or at more frequent intervals, and from breast cancer

chemoprevention. Oncology nurses could use risk assessment tools to provide education on risk factors and individualized counseling on breast cancer prevention and early detection.

Most women in the sample were at the second stage of acknowledging their personal risk to breast cancer, meaning that they perceived they were not likely, or were less likely than others to be affected by the disease. Inaccurate perceptions of risk that err on the side of underestimation do not promote the adoption of health-protective behaviors. As suggested by the theoretical framework of the study, inaccurate perceptions of risk might also predispose individuals to be less receptive in acknowledging personal susceptibility to breast cancer. The latter might prove to be especially significant for high-risk women who underestimate their risk. Providing comparative risk information might better help women acknowledge their risk and adopt screening practices appropriate for their level of risk. Future educational interventions should incorporate ways to assess preexisting knowledge about breast cancer risk factors, readiness to learn, and receptiveness to health-related education.

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Appendices

Table 1. Demographic Characteristics

Variable		N	%
Age	X= 47.59±12.05, range: 30 to 84		
	30 to 39	56	30
	40 to 49	50	27
	50 to 69	61	33
	70 to 85	11	7
	Missing	6	3
	Total	184	
Race/Culture			
	Non-Hispanic White	79	43
	Non-Hispanic Black	50	26
	Hispanic	25	14
	Asian	30	17
Education			
	Grades 1 through 8 (Elementary)	7	4
	Grades 9 through 11 (Some high School)	8	4
	Grade 12 or GED (High School Graduate)	31	17
	College 1 year to 3 years (Some college or Technical School)	48	26
	College 4 years or more (College graduate)	90	49
Income			

<$10,000	39	21
$10,000 - <$20,000	16	8
$20,000 - <$30,000	33	18
$30,000 - <$40,000	28	16
$40,000 - <$50,000	17	9
$50,000 - <$60,000	16	9
$60,000 - <$70,000	6	3
$70,000 - <$80,000	2	1
>$80,000	19	11
Missing	8	4

Family History

No Family History	117	64
≥1 affected SDRs	39	21
≥1 affected FDR	19	11
Missing	8	4

SDRs = Second-Degree Relatives

FDRs = First-Degree Relatives

Table 2. Predictors of Perceived Breast Cancer Risk

Criterion Variable: Verbal scale

$R^2 = 0.15 \ \Delta F = 2.21, \ p = 0.017$

Predictors	sr^2	B	95%CI for B
Education	0.001	0.04	-0.25 – 0.34
Income	0.013	-0.07	-0.17 – 0.03
Asian vs. White Dummy	0.003	0.27	-0.52 – 1.06
Black vs. White Dummy	0.007	0.36	-0.36 – 1.08
Hispanic vs. White Dummy	0.001	0.15	-0.69 – 0.99
Age	0.013	-0.02	-0.03 – 0.02
Age of First Menstrual Period	0.017	0.20*	0.03 – 0.60
Age at First Live Birth	0.004	-0.01	-0.02 – 0.02
Number of Breast Biopsies	0.004	0.14	-0.19 – 0.50
Number of Affected FDRs	0.009	0.36	-0.39 – 0.80
Number of Affected SDRs	0.052	0.56*	0.20 – 0.96

Criterion Variable: Comparative scale

$R^2 = 0.22 \ \Delta F = 3.75, \ p < 0.001$

Predictors	sr^2	B	95%CI for B
Education	0.038	0.18*	0.03 – 0.33
Income	0.009	-0.03	-0.08 – 0.02

Asian vs. White Dummy	0.004	0.15	-0.25 – 0.56
Black vs. White Dummy	0.001	-0.003	-0.37 – 0.37
Hispanic vs. White Dummy	0.001	-0.06	-0.49 – 0.37
Age	0.011	-0.02**	-0.03 – -0.02
Age of First Menstrual Period	0.001	0.01	-0.11 – 0.13
Age at First Live Birth	0.001	0.001	-0.01 – 0.01
Number of Breast Biopsies	0.001	0.03	-0.15 – 0.20
Number of Affected FDRs	0.043	0.41*	0.10 – 0.71
Number of Affected SDRs	0.012	0.44**	0.25 – 0.63

R^2 = Proportion of variance in the criterion variable explained by the equation

ΔF = Change in F test, comparing this model to the null model

sr^2 = Squared partial correlation. Proportion of variance explained by one predictor while other

predictors are controlled

B = Standardized regression coefficient indicating the change in the criterion variable associated

with the specific predictor

*$p<0.05$, **$p<0.001$

Table 3. Percentage of accurate and inaccurate risk responses on the Verbal scale

	Verbal scale ≤6 "Perceive definitely or probably will not get breast cancer, or chances are fifty-fifty"	Verbal scale >6 "Perceive definitely or probably will get breast cancer"
5-year Gail score ≤ 1.67% Low Risk N=151	N=144 (96%) Accurate perception of risk	N=6 (4%) Overestimate risk
5-year Gail score > 1.67% High Risk N=24*	N=23 (96%) Underestimate risk/ Optimistic bias	N=1 (4%) Accurate perception of risk

* Missing data on the Verbal scale from one high-risk woman

Table 4. Percentage of accurate and inaccurate risk responses on the Comparative scale

	Comparative scale ≤3 "Perceive risk to be lower or the same as risk of average, same-age women"	Comparative scale >3 "Perceive risk to be higher than average, same-age women"
5-year Gail score ≤ 1.67% Low Risk N=151	N= 137 (91%) Accurate perception of risk	N=14 (9%) Overestimate risk
5-year Gail score > 1.67% High Risk N=25	N=20 (80%) Underestimate risk/ Optimistic bias	N=5 (20%) Accurate perception of risk

Table 5. Breast Cancer Screening Behavior

Screening Behavior		N	%
How long has it been since your last mammogram? *			
	Within the past year (less than 12 months ago)	62	54
	Past 2 years (1 year but less than 2 years)	23	20
	Past 3 years (2 years but less than 3 years)	4	4
	Past 5 years (3 years but less than 5 years)	4	4
	5 or more years ago	5	4
	Missing	16	14
How long has it been since your last CBE? **			
	Within the past year (less than 12 months ago)	99	54
	Past 2 years (1 year but less than 2 years)	38	21
	Past 3 years (2 years but less than 3 years)	12	6
	Past 5 years (3 years but less than 5 years)	4	2
	5 or more years ago	15	8
	Missing	16	9
How often do you do BSE?**	Never	14	8
	Rarely	69	38

Occasionally (every other month)	55	30
Regularly (every month)	33	18
Very often (more than monthly)	11	5
Missing	2	1

* Frequency of mammograms was assessed only for women in the sample who were ≥ 40 years old (N=115)

** Frequency of CBE and BSE was assessed for all women in the sample (N=184)

Table 6. Correlation among demographic characteristics, Gail risk, perceived risk, and screening behaviors

	Education	Income	Health Insurance	5-year Gail score	Lifetime Gail score	Perceived risk Verbal Scale	Perceived risk Comparative Scale
Long since last mammogram	-0.13	0.06	-0.19*	0.17*	0.05	-0.03	-0.04
Long since last CBE	-0.02	-0.17*	-0.25**	-0.12	-0.05	0.01	0.04
Often does BSE	0.04	0.03	0.07	0.06	0.01	0.12	0.06

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

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Abstract: Abstract
Background: Research emphasizes the importance of trust in decision-making regarding risk
management. Objectives: The study examined the role of distrust of the health system in routine
breast cancer screening. The study explored 1) the relation between distrust of the health system
and habits of using health services, and 2) the influence of distrust and of habits of using health
services on obtaining frequent mammograms and Clinical Breast Exams (CBEs), and time since
last mammogram and last CBE. Methods: This community-based survey recruited 184 women
(age 47 □ 12); many (49%) had college education, 21% were low income, 77% had health
insurance, and 57% were non-white. Concepts were measured with the Distrust in the Health
System scale (Cronbach $\alpha=0.71$) and the Habit of Health Services Utilization scale (Cronbach
$\alpha=0.84$). Results: Distrust of the health system did not predict screening behavior, only habits of
using health services ($sr2= 0.10$, $p<0.001$). An ageXdistrust interaction accounted for an additional
11% ($sr2= 0.11$, $p<0.001$) in the variance of habits of using health services. Habits of using health

services was the most significant predictor of CBEs; it accounted for more than 10% in the variance of frequency of CBEs (sr2= 0.13, p<0.001) and time since last CBE (sr2= 0.14, p<0.001). The most significant predictor of mammograms was age, which accounted for 45% in the variance of frequency of mammograms (sr2= 0.45, p<0.001). Income, health insurance, and habits of using health services accounted for smaller (less than 10% each), but significant percentage in the variance of frequency of mammograms and time since last mammogram. Discussion: Distrust of the health system is an indirect barrier for obtaining routine breast cancer screening. It inhibits habitual use of health services and the development of long-term relationships between women and providers, which is important for obtaining routine screening.

* Cover Letter

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COVER LETTER: DISTRUST, HABITS OF USING HEALTH SERVICES, AND DECISION

MAKING REGARDING BREAST CANCER SCREENING

1.   All authors of this research paper have participated in its drafting.
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DISTRUST, HABITS OF USING HEALTH SERVICES, AND DECISION MAKING

REGARDING BREAST CANCER SCREENING

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Acknowledgements

1   **Abstract**

2   *Background:* Research emphasizes the importance of trust in decision-making regarding risk

3   management. *Objectives:* The study examined the role of distrust of the health system in routine

4   breast cancer screening. The study explored 1) the relation between distrust of the health system

5   and habits of using health services, and 2) the influence of distrust and of habits of using health

6   services on obtaining frequent mammograms and Clinical Breast Exams (CBEs), and time since

7   last mammogram and last CBE. *Methods:* This community-based survey recruited 184 women

8   (age 47±12); many (49%) had college education, 21% were low income, 77% had health

9   insurance, and 57% were non-white. Concepts were measured with the Distrust in the Health

10   System scale (Cronbach α=0.71) and the Habit of Health Services Utilization scale (Cronbach

11   α=0.84). *Results:* Distrust of the health system did not predict screening behavior, only habits of

12   using health services (sr^2= 0.10, p<0.001). An ageXdistrust interaction accounted for an

13   additional 11% (sr^2= 0.11, p<0.001) in the variance of habits of using health services. Habits of

14   using health services was the most significant predictor of CBEs; it accounted for more than 10%

15   in the variance of frequency of CBEs (sr^2= 0.13, p<0.001) and time since last CBE (sr^2= 0.14,

16   p<0.001). The most significant predictor of mammograms was age, which accounted for 45% in

17   the variance of frequency of mammograms (sr^2= 0.45, p<0.001). Income, health insurance, and

18   habits of using health services accounted for smaller (less than 10% each), but significant

19   percentage in the variance of frequency of mammograms and time since last mammogram.

20   *Discussion:* Distrust of the health system is an indirect barrier for obtaining routine breast cancer

21   screening. It inhibits habitual use of health services and the development of long-term

22   relationships between women and providers, which is important for obtaining routine screening.
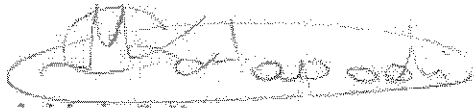
23   *Keywords: distrust of the health system, routine breast cancer screening, barriers to screening*

Introduction

1
2   Breast cancer is the second leading cause of cancer death among women in the U.S. and

3   more than 40,000 American women are expected to die from the disease during 2008. Early

4   detection of malignant breast tumors significantly decreases morbidity and mortality. Although

5   there is no consensus regarding optimum breast cancer screening recommendations, the

6   American Cancer Society (ACS) suggests that women at average/population risk obtain annual

7   Clinical Breast Exams (CBEs) and annual mammograms starting at the age of 40 years

8   (American Cancer Society, 2007).

9   Studies that examined barriers to cancer screening reported that differences in screening

10   behavior can be partially attributed to personal attitudes about the health system (Hiatt & Pasick,

11   1996). Evidence suggests that distrust of the health system has a negative impact on perceived

12   access to care, and inhibits participation in cancer screening programs (Facione & Katapodi,

13   2000). For example, distrust of health providers and the medical establishment was the primary

14   reason for African-Americans' reluctance to participate in colorectal (Greiner, Born, Nollen, &

15   Ahluwalia, 2005) and prostate cancer screening programs (Forrester-Anderson, 2005). It was

16   also reported to guide decisions to refuse treatment in cases of African-Americans with prostate

17   cancer (Jones & Wenzel, 2005), male veterans with lung cancer (Sharf, Stelljes, & Gordon,

18   2005) , and Muslim women with breast cancer (Remmenich, 2006). In a nationwide random-

19   digit-dial survey of 6,722 adults, those who reported being more distrustful of the health system

20   were less likely to adhere to medical regimens and more likely to delay needed care (Blanchard

21   & Lurie, 2004).

22   Little is known about the process by which distrust of the health system influences

23   health-related decision making. The purpose of the study was to explore whether distrust of the

24   health system influences the behavioral patterns that govern repeated behaviors. Specific aims

1   were to explore 1) the relation between distrust of the health system and habits of using health

2   services and 2) the influence of distrust and of habits of using health services on obtaining

3   routine screening mammograms and CBEs.

4   **Background and Theoretical Framework**
5
6   One of the most fundamental qualities of trust is that it is fragile; it is created rather

7   slowly, but it can be destroyed instantly by a single act of betrayal. The fact that trust is easier to

8   destroy than to create reflects a psychological mechanism, termed the "asymmetry

9   principle"(Slovic, 1999). The asymmetry principle implies that when it comes to winning trust,

10   the playing field is tilted toward distrust.

11   Explanations for the asymmetry principle draw on cognitive biases, such as "negativity

12   bias" and "confirmatory bias." Negative and trust-destroying events are more visible and

13   noticeable, carry greater weight, and are perceived as more diagnostic or informative than

14   positive events (Slovic, 1999). "Negativity bias" draws on the notion that people pay more

15   attention to and are more influenced by trust-destroying than by trust-building information.

16   When people are distrustful or when they are ambivalent about the trustworthiness of others,

17   negative information is perceived as far more informative (Poortinga & Pidgeon, 2004), and

18   negative events have great trust-decreasing impact (Cvetkovich, Siegrist, Murray, & Tragesser,

19   2002).

20   An underlying assumption of the asymmetry principle is that people have to continuously

21   re-evaluate and adapt their ideas about the trustworthiness of others. However, people do not

22   always have the time, cognitive resources, or willingness to make elaborate assessments as to

23   whether someone can be trusted or not. Trust judgments are often based on perceived similarity

24   and stereotypes rather than on carefully reasoned arguments or direct evidence (Cvetkovich et

1   al., 2002). Events with low specificity, such as general beliefs and stereotypes, often are seen as

2   representative of the norm and are perceived as more diagnostic of future performance compared

3   to specific incidences (White & Eiser, 2005). The "confirmatory bias" draws on the notion that

4   trust binds people who share similar ideas. People discount evidence that contradicts their own

5   views, while they select information that supports their existing beliefs and attitudes (White,

6   Pahl, Buehner, & Haye, 2003). As a result, distrust is self-reinforcing and self-perpetuating; it

7   inhibits personal interactions that are necessary to re-establish trust, resulting in a lack of

8   opportunities for learning about trustworthiness (Slovic, 1999).

9   Research findings emphasize the importance of trust in decision-making regarding risk

10   management, especially for risks that are considered to be managed by "experts", such as nuclear

11   waste, chemical and air pollution, climate change, and terror attacks (Shiloh, Guvenc, & Onkal,

12   2007; Slovic, 1999). A significant number of studies examined the impact of trust on the patient-

13   provider relationship, with an emphasis on shared and informed decision-making for disease

14   management (McKneally, Ignagni, Martin, & D'Cruz, 2004), genetic testing for breast cancer

15   (Ford, Alford, Britton, McClary, & Gordon, 2007), participation in clinical trials (Ding, Powe,

16   Manson, Sherber, & Braunstein, 2007), and acceptability of health care institutions (Gilson,

17   2003). Distrust of the health system has been attributed to socioeconomical, cultural, and ethnic

18   differences, and to expectations of prejudicial treatment and institutional racism (Rajaram &

19   Rashidi, 1998). Although these socioeconomic and cultural differences exist and are important

20   barriers to cancer screening, significantly less attention has been given to distrust as an

21   individual psychological characteristic.

22   Little is known about the internal psychological process that helps establish a trusting

23   relationship between a patient and a health provider. Mechanic and Meyer (Mechanic & Meyer,

1   2000) conducted in-depth interviews with 90 patients regarding their assessment of trust in their

2   providers. Trust in health providers was described as an iterative process. Participants varied in

3   their willingness to trust their physicians; they continuously made judgments of whether the

4   physician can be trusted or not. Trust calculations were mostly based on patients' intuition and

5   "gut feelings"; patients made intuitive assessments of the physician's knowledge, interpersonal

6   and technical competences, and compared treatment outcomes to their own expectations

7   (Mechanic & Meyer, 2000).

8   Based on the notion that trust calculations are intuitive, the present study explored

9   whether distrust of the health system influences health behaviors by means which involve

10   intuitive and non-deliberate cognitive processes. The study was based on the following

11   theoretical suggestions:

12   First, attitude and belief variables regarding the health system are not a direct reason for

13   using health services; rather an individual's attitudes towards the health system formulate hers or

14   his habits of using health services (Andersen & Newman, 1973). Some individuals have a

15   propensity to use health services more than others and this individual difference exists prior to

16   the onset of an illness episode. Propensity to use health services can be predicted by individual

17   characteristics, such as beliefs about the health system and the medical establishment. People

18   that have favorable attitudes towards the health system are more likely to use health services,

19   even though their attitudes are not directly responsible for using health services. Consequently,

20   we hypothesized that distrust of the health care system does not have a direct effect on breast

21   cancer screening, but influences an individual's predisposition towards using health services.

22   Second, effective breast cancer screening of asymptomatic individuals is based on the

23   assumption that screening should occur periodically and in consistent time intervals, and

1   therefore, it should become a habitual behavior. Habits are guided by non-deliberate, automated

2   cognitive processes and are considered to be mental representations of an association among a

3   cue, an action, and an outcome. Given a constant context, behavioral scripts develop if the same

4   cue is presented repeatedly, and if it is followed by the same behavior. Habitual behaviors can

5   be performed relatively easily and quickly, in parallel with other activities, and with minimal

6   attention. Thus, the development of habits for repeatedly performed behaviors helps save

7   cognitive resources and time. (Aarts, Verplanken, & van Knippenberg, 1998; Ouellette & Wood,

8   1998; Ronis, Yates, & Kirscht, 1989).

9   Third, behaviors occur as the outcome of two decision-making channels: one's intentions

10   and one's habits (Triandis, 1980). A meta-analysis of prior research substantiated that in cases

11   of strong habits, the behavior will probably re-occur in a constant context. Conscious decision

12   making might be blocked, because the process that initiates and controls the performance of the

13   behavior becomes automatic. When habits are weak and the behavior is not well learned or

14   when the context is unstable or unfavorable, the behavior is likely to be initiated and performed

15   after conscious decision making, which requires more intentional attention from the individual

16   and more cognitive and emotional resources (Ouellette & Wood, 1998).

17   Consistent with the above theoretical suggestions, we hypothesized that breast cancer

18   screening would be inconsistent with ACS recommended guidelines for women with a negative

19   predisposition towards the health system and those with weak habits of using health services.

20   **Design, Recruitment, and Procedures**
21
22   Data were obtained from a survey that examined perceived breast cancer risk and breast

23   cancer screening behaviors. The cross-sectional survey was advertised as "Women's Breast

24   Health Study" and recruited a convenience sample from community settings throughout the San

1 Francisco Bay Area. Women were eligible to participate if they were between the ages of 30 and

2 85, had never been diagnosed with any type of cancer, and were willing to complete a

3 questionnaire in English. The minimum age limit of 30 years was chosen because some

4 aggressive types of breast cancer occur in women in their thirties (American Cancer Society,

5 2007). The maximum age limit was set at 85 years because that is the maximum age that breast

6 cancer risk can be estimated objectively, which was a requirement of the parent study. Women

7 with a prior diagnosis of any type of cancer were excluded because the focus of the study was on

8 secondary prevention of breast cancer.

9   Recruitment was done through local newspapers and through flyers posted in places that

10 women were likely to visit in their daily living, such as senior and cultural centers, homeless

11 shelters, libraries, restaurants, coffee shops, churches, temples, and workplaces. Potential

12 participants responded by calling a dedicated telephone number and expressing their interest in

13 the study. Eligibility for study participation was assessed and the survey was administered face-

14 to-face in places that were convenient for every participant. Participants were paid $15. The

15 University of California San Francisco Committee on Human Rights and the Institutional

16 Review Board of the funding agency approved the study protocol.

17   **Methods**

18   *Measures*

19   *a) Distrust of the Health System.* Based on the suggestions that distrust is self-sustained

20 through the negativity and confirmatory biases, four items were developed to directly target

21 distrust as a factor influencing disease management. The four items were: "I trust my health

22 providers"; "I always believe someone when they say that their health provider hasn't been nice

23 to them"; "In general, the health care system is not sensitive to the patients' needs"; and "I 've

1   been treated poorly by health providers more often than I 've been treated with respect."

2   Participants were asked to indicate the degree to which they agreed with each of the four

3   statements on a four-point Likert-type scale (strongly agree to strongly disagree).

4   The Internal Consistency of the items was evaluated using factor analytic methods. The

5   four items loaded on a single principal component and explained 54% of the variance in distrust

6   of the health system. Individual loadings ranged from 0.63 to 0.78. Internal Reliability

7   (Cronbach alpha) of the items was 0.71. Based on these analyses, the four items were summed

8   to create the measure of *Distrust of the Health System (DHS)* used in the study. According to the

9   asymmetry principle, which suggests that individuals are inclined towards distrust, higher scores

10   in the DHS scale indicate greater distrust.

11   We used the Personally Experienced Prejudice (PEP) scale to evaluate the Convergent

12   validity of the DHS scale. The PEP scale measures women's personal experience of prejudice

13   within the health system (Facione & Facione, 2007). There was a significant positive correlation

14   between the DHS scale and the PEP scale ($r=0.58$, $p<0.001$), which confirmed our assumption

15   that individuals that reported having personal experiences with prejudicial treatment within the

16   health system were more likely to be more distrustful of the health system.

17   Convergent validity of the DHS scale was also evaluated by examining the association

18   between acculturation and distrust. Acculturation represents the extent to which a member of an

19   ethnic group embraces the traditions, values, beliefs, assumptions, and practices of the host

20   society. Assessment of acculturation was based on an individual's preference to use English

21   over another language (Marin, Sabogal, Marin, Otero-Sabogal, & Perez-Stable, 1987), and was

22   measured for the 55 Asian and Hispanic women in the sample whose English was a second

23   language. There was a significant negative correlation between acculturation and distrust ($r=-$

1   0.27, p<0.05), which confirmed our assumption that lower acculturation would be associated

2   with higher distrust.

3   Finally, we followed suggestions by Samsa and colleagues (Samsa et al., 1999) to

4   determine the Clinically Important Difference (CID) in the DHS scale; this was chosen as 0.3

5   measured in Cohen's d i.e. more distrustful people should differ by 30% from less distrustful

6   people on the standard deviation reflected in the DHS scale. The pooled standard deviation in

7   the sample in the DHS scale was 2.379 which yields an estimated CID = 0.71 in distrust. For the

8   current sample the observed difference between more and less distrustful people was 0.72 in SD

9   units, which exceeds the estimated CID.

10   *b) Habit of Health Services Utilization.* Habits of using health services were measured

11   with the *Habit of Health Services Utilization (HHSU)* scale (Facione, Miaskowski, Dodd, &

12   Paul, 2002). The scale measures an individual's predisposition to use health services; examples

13   of items are "I usually follow all the recommendations of getting check ups", and "I really have

14   to be hurting before I go to the doctor." The items of the scale introduce very general

15   information regarding seeking wellness checkups and evaluation of illness symptoms from

16   health providers. Presumably, the latter items force participants to rely on their behavioral

17   scripts regarding predisposition to use health services, whereas items that assess breast cancer

18   screening are based on recall of specific behaviors. Internal Reliability (Cronbach alpha) of the

19   items was 0.84 in this sample.

20   *c) Breast Cancer Screening Behaviors.* Screening behavior was assessed with questions

21   used in the 2001 survey of the Behavioral Risk Factors Surveillance System (CDC, 2002).

22   Participants were asked *how often* they have a screening mammogram and a CBE, and *how long*

23   it has been since their last mammogram and their last CBE. Based on these questions, four

1   variables were created to assess: frequency of mammogram ("0" *Never* to "3" *Every one to two*

2   *years)*, frequency of CBE ("0" *Never* to "4" *Every year)*, time since last mammogram ("1"*Within*

3   *the past year - less than 12 months ago* to "5" *5 or more years ago)*, and time since last CBE

4   ("1" *Within the past year - less than 12 months ago* to "5" *5 or more years ago)*. For the

5   purposes of statistical analyses the above variables were considered continuous.

6   *d) Family History.* Family history (FH) of breast cancer was dichotomized as "0"

7   indicating a negative family history of breast cancer and "1" indicating a positive family history.

8   *Statistical Analyses*

9   Data were analyzed using the SPSS 14® statistical program. We calculated individual

10   scores when at least 60% of items were completed. Distributions were checked for normality.

11   Power analysis indicated that a sample of N=147 would provide Power=0.80 to detect moderate

12   correlations among predictive variables (R^2 =0.13) with alpha=0.05. We used descriptive

13   statistics for demographic characteristics, bivariate analyses (Pearson correlation) and

14   multivariate analyses (ANOVA) with Bonferroni post hoc contrasts to describe differences in

15   distrust and habits of using health services.

16   We performed a series of regression analyses a) to identify the relation between distrust

17   and habits of using health services, b) to test for a moderator effect between distrust of the health

18   system and socioeconomic characteristics, c) to identify predictors of breast cancer screening

19   behaviors, and d) to examine whether habits of using health services mediate the relation

20   between distrust of the health system and screening behaviors. Collinearity diagnostics was

21   assessed with the Variance Inflation Factor (V.I.F.), which was lower than 1.5 for all predictors

22   and in all models tested. The goodness of fit for each linear regression model was assessed using

1   the model effect size (R^2) and ANOVA (F) tests. The unique contribution of each predictor after

2   controlling for other predictors was assessed with the squared partial correlation (sr^2).

3
4   **Results**
5   *Sample*

6   The community-based survey recruited a multicultural sample of 184 women. A large

7   percentage (49%) had attended four or more years of college; the median annual family income

8   was <$40,000. Although the sample was broadly comparable to the San Francisco Bay Area

9   population, there was an over-representation of black women and women with college education

10   (US Census, 2000). Scores were normally distributed on the DHS (9.17 ± 2.12) and the HHSU

11   (34.94 ± 5.50) scales. There were no significant differences in levels of reported distrust among

12   women of different ethnic/cultural and socioeconomical background in the sample. There was a

13   significant negative correlation between distrust of the health system and age ($r = -0.19$, $p = 0.07$),

14   indicating that younger women in the sample were significantly more likely to report higher

15   levels of distrust. Table 1 describes the socioeconomic characteristics of the sample.

16   *Does distrust of the health system influence habits of using health services?*

17   Regression analysis was used to examine whether socioeconomic characteristics, family

18   history of breast cancer, and distrust of the health system predicted women's habits of using

19   health services. The model was significant ($p = 0.004$) with distrust being the single most

20   important negative predictor of habits of using health services.

21   The possibility of a moderator effect between distrust of the health system and

22   socioeconomic characteristics was explored. To test for a moderator effect, all predictors were

23   entered in the first step of a hierarchical regression followed by the interaction term in the second

24   step. A moderator effect is present if the interaction term accounts for a statistically significant

1   change in the R^2 of the dependent variable (HHSU scale) (Baron & Kenny, 1986). A significant

2   interaction between age and distrust of the health system accounted for an additional 11% ($sr^2 =$

3   0.11, p<0.001) in the variance of habits of using health services, which was above and beyond

4   contributions made by other predictors in the model (see Table 2).

5   *Do distrust and habits of using health services influence breast cancer screening?*

6   Frequency of screening mammograms was assessed only for women who were older than

7   40 years of age (N=115, range: 40-84, Mean Age = 53±9). The majority of these women (69%)

8   reported having a screening mammogram every one to two years. However, 12% reported that it

9   had been more than 24 months since their last mammogram. Frequency of CBE was assessed

10   for all women in the sample (N=184). Most women (59%) reported having a CBE every year;

11   however, 16% reported that it had been more than 24 months since their last CBE (See Table 3).

12   Four regression analyses were used in order to examine predictors of breast cancer

13   screening behavior. Socioeconomic characteristics, distrust of the health system, and habits of

14   using health services were the predictor variables, while there were two dependent variables

15   regarding use of screening mammograms and two dependent variables regarding use of CBEs.

16   All models were significant and explained significant variance in each dependent variable.

17   Distrust of the health system was not a significant predictor of any dependent variable. Habits of

18   using health services were a significant predictor for three out of the four dependent variables.

19   Other significant predictors included age, annual family income, health insurance, and

20   race/ethnicity (See Table 4). There were no significant interactions among the different

21   predictors in the model.

22   In order to examine whether habits of using health services was a mediator between

23   distrust of the health system and breast cancer screening behaviors, we removed habits of using

1   health services from the previous four models. By removing habits of using health services from

2   the regression models, distrust of the health system did not become a significant predictor of

3   breast cancer screening. This finding suggests that habits of using health services did not

4   mediate the relationship between distrust and screening behavior. Figure 1 presents the findings

5   of the study.

6   **Discussion**

7
8   The study examined distrust of the health system as a cognitive factor that influences an

9   individual's habits of using health services and breast cancer screening behavior. Distrust of the

10   health system did not have a direct effect on screening behavior. Rather, it was the single most

11   important predictor of habits of using health services, which in turn were a significant predictor

12   or breast cancer screening. Findings of the study support the theoretical suggestion that attitude

13   variables regarding the health system do not have a direct effect on health behavior, but rather

14   influence an individual's predisposition to use health services (Andersen & Newman, 1973).

15   Therefore, examining distrust of the health system and habits of using health services is an

16   important step towards understanding habitual decision-making patterns. Decisions to adhere to

17   recommended breast cancer screening guidelines are made repeatedly over time, are relatively

18   simple, and entail low perceived risk (Katapodi, Dodd, Lee, Facione, & Cooper, 2004).

19   Consequently, we assumed that these decisions acquire habitual qualities, especially for women

20   that have health insurance and should uniformly be advised to obtain annual breast cancer

21   screening.

22   Weak habits of using health services could be attributed either to lack of accessible

23   mental representations or to an unfavorable evaluation of the experience of using health services

24   (Lindblach & Lyttkens, 2002). Therefore, weak habits of using health services could be

1   attributed 1) to absence of cues for the behavior (lack of a consistent source of health care, lack

2   of physician recommendation), 2) to an unstable or unfavorable context that interferes with the

3   continuum cue → behavior → outcome (perceived difficulty in navigating the health system), and

4   3) to a negative assessment of the outcome of seeking health care (medical treatments are

5   perceived as painful, prejudicial, culturally unacceptable). Based on findings of the current study

6   and previous research, we suggest that distrust inhibits use of health services presumably because

7   individuals with greater distrust perceive that the health care setting is an unstable and hostile

8   environment. These individuals are probably more alert and more vigilant in monitoring the

9   behavior of health providers and in evaluating treatment outcomes. Unstable mental

10   representations regarding health services interfere with the development of habitual use of such

11   services. The study makes a significant contribution to the existing body of knowledge

12   regarding the role of distrust in disease management because it proposes a process with which

13   distrust influences health-related behavior. However, findings of the study need to be replicated

14   with larger samples before concrete conclusions can be made.

15   Habits of using health services was a significant predictor of obtaining CBEs, accounting

16   for a significant percentage in the variance of frequency of CBEs (13%) and time since last CBE

17   (14%), while it accounted for a smaller, albeit significant, percentage in the variance of

18   frequency of mammograms (4%). Seeking a provider visit for a CBE is the first step towards

19   obtaining routine breast cancer screening, and partially reflects the interpersonal relationship

20   between a patient and her health provider. When habits of using health services are weak or

21   lacking, then initiating a provider visit for a CBE requires more cognitive and emotional

22   resources for the mobilization of the individual and the performance of the behavior. This

1   increased need for cognitive and emotional resources most likely results in an inconsistent use of

2   health services and interferes with obtaining breast cancer screening on a routine basis.

3   Age was the most significant predictor of mammography screening, accounting for 45%

4   of the variance in frequency of obtaining a mammogram. Women in the sample who were older

5   than 50 years of age were more likely to get a physician recommendation for an annual

6   mammogram, whereas some women who were between 40 and 50 years old may not have been

7   advised to get annual mammograms. Efforts of health programs to target older women for

8   screening mammograms outweigh commonly reported barriers, such as income and health

9   insurance (Miller & Champion, 1996). Presumably, such efforts also help establish

10 trustworthiness in the health system and enhance habitual behaviors that entail routine breast

11 cancer screening. It is possible that older women in the sample were less distrustful because they

12 had more opportunities to interact with health providers and to trust the medical establishment.

13 The latter suggestion is based first, on the significant negative correlation between age and

14 distrust observed in the sample and second, on the observed interaction between age and distrust

15 and its impact on habits of using health services. It is also consistent with the observation that in

16 cases of managing chronic illness, trust in health providers was largely based on the long-term

17 experiences with the provider (Thorne & Robinson, 1989).

18   It is very difficult to distinguish whether distrust of the health system can be attributed to

19 racial/cultural characteristics, to socioeconomic factors, or to psychological tendencies and

20 cognitive biases. Studies have repeatedly reported that blacks are more distrustful of the health

21 system than whites. Although it is reasonable to assume that the most distrustful women are

22 those from minority groups and those with low socioeconomic status, this assumption was not

23 confirmed in the study. It is possible that trust in health providers helps overcome some

1   common barriers of access to care, which are imposed by socioeconomic factors and by

2   expectations of culturally appropriate behavior. For women from minority backgrounds that

3   have higher education and income, distrust of the health system is less likely to represent a

4   vulnerable position within the dominant culture; these women are probably more like the

5   dominant culture independent of their race. However, future studies with larger, stratified

6   samples might help distinguish among racial/cultural, socioeconomic, and cognitive

7   determinants of distrust.

8   The limitations of the study should be considered, to properly temper any conclusions.

9   First, the results are based on a convenience sample of English-speaking and mostly urban

10   women. Since women show lower distrust of medical researchers compared to men (Ding et al.,

11   2007), it is possible that findings are not representative of the general population but reflect

12   lower levels of distrust observed in this self-selected sample of women. Second, assessment of

13   screening behaviors was based on self-report and may not be accurate. Third, the study focused

14   exclusively on examining patient characteristics as predictors of screening behavior, whereas it

15   did not examine beliefs regarding the availability, accessibility, and acceptability of health

16   services as predictors of habits of using health services. Finally, although the overall sample

17   provided adequate power, the stability of the examined relations might be limited by the small

18   number of women who self-identified as Hispanic and Asian. Despite these limitations, the

19   strength of the study is that it recruited women from diverse socioeconomic and racial/ethnic

20   backgrounds and from community settings, which ensured that participation in the study was not

21   limited to women that had greater access to health services.

22   The study has implications regarding the importance of establishing trustworthiness in

23   long term relationships between patients and clinicians, and the association between developing

1   habits of using health services and obtaining routine screening. Our findings suggest that in

2   situations of existing distrust of the health system it is difficult to establish consistent screening

3   behaviors. This finding has significant clinical implications, especially in situations that women

4   have to seek medical evaluation in a novel or unfamiliar context. For example, decisions to

5   obtain routine breast cancer screening may not be guided by the same decision-making rules as

6   decisions to seek medical evaluation of an unusual breast symptom, or in cases of immigrant and

7   non-English speaking women. Further research should examine the salience of cues embedded

8   in the social discourse between patient and provider and explore the context that motivates

9   personal health behaviors.

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Appendix
Tables and Figures

Table 1. Socioeconomic Characteristics of the Sample

Variable		N	%
Age	X= 46.59±12.05, range: 30 to 84		
Race/Ethnicity			
	White	79	43
	Black	50	27
	Hispanic	25	14
	Asian	30	16
Education			
	Grades 1 to 8, Elementary School	7	4
	Grades 9 to 11, some High School	8	4
	Grade 12, or GED, High School Graduate	31	17
	College 1 to 3 years, some College or Technical School	48	26
	College ≥ 4 years, College Graduate	90	49
Annual Family Income			
	<$10,000	39	21
	$10,000 - $30,000	49	27
	$30,000 - $50,000	45	24
	$50,000 - $70,000	22	13
	>$70,000	21	11
	Missing	8	4
Employment Status			
	Employed full-time	102	55
	Unemployed, Employed part-time, Retired, Student	82	45
Health Insurance			
	Yes	142	77
	No	38	21
	Missing	8	2
Marital Status			
	Married or Member of an Unmarried Couple	60	33
	Divorced, Separated, or Widowed	54	29
	Never Married	69	38

Table 2. Predictors of Habits of Using Health Services

Step 1
$R^2 = 0.14$ $\Delta F = 2.86$, $p = 0.004$

Predictors	sr^2	B	95%CI for B
Age	0.0004	-0.01	-0.08 – 0.06
Education	0.0001	-0.07	-1.07 – 0.94
Income	0.0010	0.07	-0.27 – 0.41
Insurance	0.010	1.41	-0.85 – 3.68
Asian vs. White	0.010	1.65	-0.91 – 4.20
Black vs. White	0.0004	0.30	-1.93 – 2.52
Hispanic vs. White	0.0132	1.99	-0.75 – 4.72
Family History	0.008	1.06	-0.81 – 2.94
Distrust of Health Services	0.104	-0.85**	-1.25 – -0.45

Step 2
$R^2 = 0.27$ $\Delta F = 3.28$, $p = 0.002$

Predictors	sr^2	B	95%CI for B
Age X Distrust of Health Services	0.11	-0.07**	-0.11 – - 0.04
Education X Distrust of Health Services	0.006	- 0.28	-0.90 – 0.33
Income X Distrust of Health Services	0.0001	0.01	-0.22 – 0.24
Insurance X Distrust of Health Services	0.003	0.36	-0.72 – 1.45
Asian vs. White X Distrust of Health Services	0.0003	- 0.22	-2.30 – 1.87
Black vs. White X Distrust of Health Services	0.009	0.66	-0.49 – 1 .80
Hispanic vs. White X Distrust of Health Services	0.018	- 1.08	-2.39 – 0.22
Family History X Distrust of Health Services	0.012	- 0.66	-1.65 – 0.33

R^2 = Proportion of variance in the criterion variable explained by the equation

ΔF = Change in F test, comparing this model to the null model in step 1

sr^2 = Squared partial correlation. Proportion of variance explained by one predictor while other predictors are controlled

B = Un-standardized regression coefficient indicating the change in the criterion variable associated with the specific predictor

*p<0.05, **p<0.001

Table 3. Breast Cancer Screening Behavior

Screening Behavior		N	%
How often do you have a mammogram? *	Never	14	12
	Once or twice before	17	15
	Every one to two years	80	69
	Missing	4	4
How long has it been since your last mammogram?			
	Within the past year (less than 12 months ago)	62	54
	Past 2 years (1 year but less than 2 years)	23	20
	Past 3 years (2 years but less than 3 years)	4	4
	Past 5 years (3 years but less than 5 years)	4	4
	5 or more years ago	5	4
	Missing	16	14
How often do you have a CBE?**			
	Never	19	10
	Once before	11	6
	Every 2 to 3 years	41	22
	Every year	108	59
	Missing	5	3
How long has it been since your last CBE?			
	Within the past year (less than 12 months ago)	99	54
	Past 2 years (1 year but less than 2 years)	38	21
	Past 3 years (2 years but less than 3 years)	12	6
	Past 5 years (3 years but less than 5 years)	4	2
	5 or more years ago	15	8
	Missing	16	9

* Frequency of mammograms was assessed only for women in the sample who were $\geq$ 40 years old (N=115)

** Frequency of CBE was assessed for all women in the sample (N=184)

Table 4. Predictors of Breast Cancer Screening Behavior

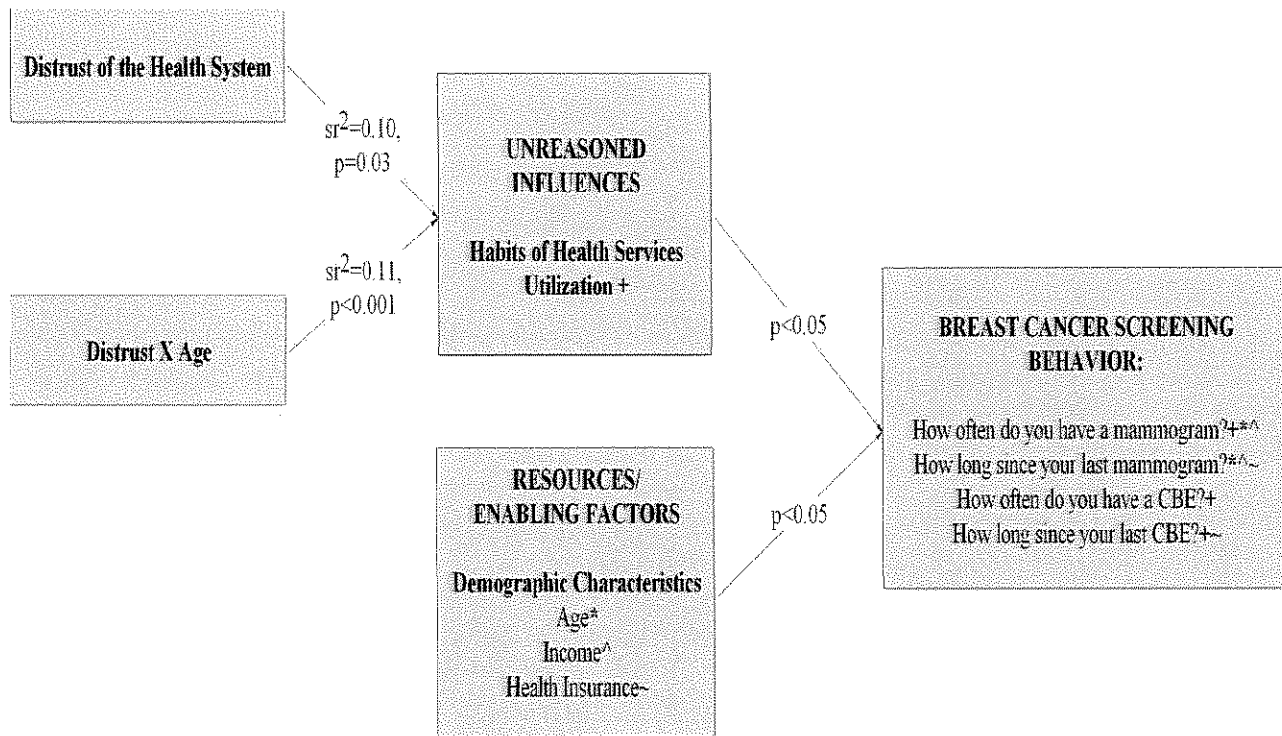|	Screening Behavior											
	Criterion Variable: "How often do you have a mammogram?" $R^2=0.53$ $\Delta F=16.48$ $p<0.001$			Criterion Variable: "How long since your last mammogram?" $R^2=0.19$ $\Delta F=3.00$ $p=0.002$			Criterion Variable: "How often do you have a CBE?" $R^2=0.16$ $\Delta F=2.88$ $p=0.003$			Criterion Variable: "How long since your last CBE?" $R^2=0.21$ $\Delta F=3.83$ $p<0.001$		
Predictors	sr^2	**B**	**95%CI for B**	sr^2	**B**	**95%CI for B**	sr^2	**B**	**95%CI for B**	sr^2	**B**	**95%CI For B**
Age	**0.45**	**0.05****	0.04 –0.06	**0.08**	**0.03****	0.01– 0.05	0.01	0.00	-0.01 – 0.01	0.01	-0.01	-0.02 – 0.01
Education	0.01	0.00	-0.13 –0.12	0.03	-0.24	-0.50 – 0.01	0.01	0.02	-0.14 – 0.21	0.01	-0.07	-0.28 – 0.17
Income	**0.03**	**0.05***	0.01 – 0.09	**0.04**	**0.09***	0.01 – 0.18	0.01	0.01	-0.05 – 0.07	0.01	-0.04	-0.11 – 0.04
Insurance	0.01	-0.15	-0.45 –0.15	**0.08**	**-1.08****	-1.71 - -0.46	0.01	0.13	-0.32 – 0.50	**0.03**	**-0.59***	-1.12 - -0.10
Asian vs. White	0.01	-0.02	-0.35 –0.32	0.02	-0.43	-1.11 – 0.25	**0.03**	**-0.62***	-0.97 - -0.06	0.01	0.14	-0.54 – 0.67
Black vs. White	**0.05**	**0.37***	0.09 – 0.66	0.01	-0.18	-0.72 – 0.36	0.01	-0.18	-0.58 – 0.22	0.01	0.17	-0.30 – 0.68
Hispanic vs. White	0.01	0.02	-0.33 –0.36	0.01	-0.19	-0.87 – 0.49	0.01	-0.16	-0.65 – 0.33	0.01	0.03	-0.56 – 0.67
Family History	0.01	0.06	-0.18 –0.30	0.01	0.25	-0.21 – 0.70	0.01	-0.04	-0.40 – 0.28	0.01	0.01	-0.35 – 0.48
Distrust of the Health System (DHS)	0.01	0.01	-0.05 –0.06	0.01	-0.04	-0.14 – 0.07	0.01	0.02	-0.01 – 0.03	0.03	-0.07	-0.17 – 0.02
Habits of Health Services Utilization (HHSU)	**0.04**	**0.02***	0.01 – 0.05	0.02	-0.03	-0.08 – 0.01	**0.13**	**0.07****	0.04 – 0.10	**0.14**	**-0.09****	-0.12 - -0.05

R^2 = Proportion of variance in the criterion variable explained by the equation
ΔF = Change in F test, comparing this model to the null model
sr^2 = Squared partial correlation. Proportion of variance explained by one predictor while other predictors are controlled
B = Un-standardized regression coefficient indicating the change in the criterion variable associated with the specific predictor
*p<0.05, **p<0.001

Figure 1. Theoretical Framework and Findings

Distrust of the Health System

$sr^2=0.10$, p=0.03

$sr^2=0.11$, p<0.001

Distrust X Age

UNREASONED INFLUENCES

Habits of Health Services Utilization +

p<0.05

RESOURCES/ ENABLING FACTORS

Demographic Characteristics
Age*
Income^
Health Insurance~

p<0.05

BREAST CANCER SCREENING BEHAVIOR:

How often do you have a mammogram?+*^
How long since your last mammogram?*^~
How often do you have a CBE?+
How long since your last CBE?+~

EXPERIENCES WITH BREAST CANCER, HEURISTICS, AND OPTIMISTIC BIAS

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Data collection and initial analysis was done at the University of California San Francisco, School of Nursing while the corresponding author was a Ph.D. student.

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Abstract

Background: Studies reported that some women perceive that they are less likely than others to be affected by breast cancer, and that this optimistic bias persists despite tailored educational interventions. **Purpose:** To identify contextual and informational processing factors that decrease optimistic bias regarding breast cancer risk. We examined 1) whether experiences with affected family members, affected friends, and abnormal breast symptoms, namely current symptoms and previous biopsies, decrease optimistic bias, and 2) whether worry and knowledge of risk factors acted as mediators or moderators between these experiences and risk assessments. **Methods:** This cross-sectional community-based survey recruited 184 middle-aged (47±12), well-educated women from diverse racial/cultural backgrounds. **Results:** Participants had moderate worry and moderate knowledge regarding breast cancer risk factors. Optimistic bias was not influenced by demographic characteristics. A series of simultaneous and hierarchical regression analyses revealed that having multiple affected family members, worry, and knowledge of risk factors significantly decreased optimistic bias. In contrast, affected friends increased optimistic bias. Worry mediated the relation between having current breast symptoms and optimistic bias. Knowledge of risk factors was a moderator between optimistic bias and participants with one or more breast biopsies and a subset of participants with a positive family history. Findings suggest three possible pathways with which experiences are incorporated into risk assessments. **Conclusions:** We discuss cognitive mechanisms with which experiences, worry, and knowledge of risk factors decrease optimistic bias. Interventions should assess knowledge, take into account inappropriate use of heuristics, and implement contextually relevant approaches to enhance information processing.

Word count: 248

Introduction

Breast cancer is the most common cancer in U.S. women and early detection has long

been recognized for its value in reducing disease mortality (American Cancer Society, 2006). A

great effort from health-related sources and the media is devoted to disseminating information

about the disease. The main assumption behind these efforts is that by educating the public about

risk factors and by increasing the accuracy of perceived breast cancer risk, health educators will

promote the adoption of protective behaviors among women, at a level that is appropriate for

each individual's level of risk (Curry, Byers, & Hewitt, 2003; Leventhal, Kelly, & Leventhal,

1999; Yabroff & Mandelblatt, 1999).

Despite their important role in cancer prevention and screening, risk judgments about the

probability of developing breast cancer are often erroneous and biased. Reports of inaccurate

breast cancer risk judgments are pervasive in the literature; some studies report that most high

risk women underestimate their breast cancer risk (Katapodi, Dodd, Lee, & Facione, Under

Review; Sabatino et al., 2004) (add Haas reference), while others report that most women

overestimate their breast cancer risk (Buxton et al., 2003; Daly et al., 1996; Davids, Schapira,

McAuliffe, & Nattinger, 2004; Dolan, Lee, & McGrae-McDermott, 1997; Metcalfe & Narod,

2002) (fix these references).

Little is known about how such erroneous and systematically biased perceptions of breast

cancer risk originate. The exact determinants of optimistic and pessimistic bias when making

risk judgments are not known. The goal of the present study is to explore possible biasing

mechanisms for how women make comparative judgments regarding their breast cancer risk.

widely replicated in the literature on comparison judgments. For example, numerous studies

reported that people have the pervasive tendency to systematically believe that they are better

than others in various ways or that they are less likely than others to encounter life's negative

events (i.e. they are better drivers, more fair, more polite, less likely to have a heart attack than

others) (Alicke, Klotz, Breitenbecher, Yurak, & Vredenburg, 1995; Klein & Weinstein, 1997;

Messick, Bloom, Boldizar, & Samuelson, 1985; Svenson, 1981)

Most women do not take into account factual information when making risk judgments

(Daly et al., 1996). Most women hold an optimistic bias and systematically believe that they are

less likely than their friends to be affected by the disease (Absetz, Aro, Rehnberg, & Sutton,

2000; Aiken, Fenaughty, West, Johnson, & Luckett, 1995; Clarke, Lovegrove, Williams, &

Machperson, 2000; Facione, 2002; McDonald, Thorne, Pearson, & Adams-Campbell, 1999).

The majority of high-risk women underestimate their breast cancer risk, while only a small

percentage of average/population risk women overestimate their risk (Katapodi et al., Under

Review; Sabatino et al., 2004). Others reported that overall women have a pessimistic bias and

overestimate their breast cancer risk (Buxton et al., 2003; Daly et al., 1996; Davids et al., 2004;

Dolan et al., 1997; Metcalfe & Narod, 2002). **Fix these references**

A possible explanation for these observations is that a person who is unaware about a

health problem and associated risk factors is responsive in learning about the problem, whereas a

person who considers that specific situations are not risk factors maintains a biased opinion

(Weinstein, 1988). If a woman is committed to a particular point of view, she will selectively

attend to messages that support her own position. She will show belief perseverance when faced

with disconfirming evidence, and she will not be responsive to formal messages regarding causes

and risk factors. Alternative avenues to accurate perceptions of risk might operate through

experiential learning. Opportunities for experiential learning present when women encounter the

disease in their daily living, such as with experiences with affected family members, affected

friends, and mammography recalls or other abnormal breast symptoms. Therefore, research

needs to determine the factors that influence women's responsiveness to information regarding

their breast cancer risk. Although messages from the media and health-related sources enhance

acknowledgement of a health problem, they are unlikely to assert their influence beyond

awareness of screening, because they do not clearly differentiate who is likely to be affected

(Rimer, 1997). As a consequence, most individuals perceive that they are not at risk for the

disease, or perceive they are less likely than others to be affected. This phenomenon has been

termed "optimistic bias" (Weinstein, 1988). Optimistic bias has been demonstrated expensively

in research studies (Klein & Weinstein, 1997; Weinstein, 1982, 1983; Weinstein & Klein, 1995),

and has been documented for perceived breast cancer risk (Absetz et al., 2000; Aiken et al.,

1995; Clarke et al., 2000; Facione, 2002; McDonald et al., 1999)

Programs that aim to promote the adoption of protective behaviors focus on educating

women about breast cancer risk factors (Leventhal et al., 1999). However, inaccurate

perceptions of risk persist despite tailored educational interventions. A meta-analysis that

summarized results of interventions aiming to increase breast cancer screening rates concluded

that behavioral interventions increased screening rates by 13.2%; cognitive interventions that

used generic education strategies had little impact, and those that used theory-based education

increased screening rates by 23.6% (Yabroff & Mandelblatt, 1999).

Research on comparison judgments has widely replicated phenomena of optimistic bias;

participants perceived that they were less likely than their peers to encounter life's negative

events.

Theoretical Framework and Background

Theoretical models that aim to explain how and why individuals initiate and maintain a health-protective behavior adopt a decision-making perspective that is focused on a cost-benefit analysis of consequential outcomes. The majority of these theoretical models assume that *perceived risk to a disease* is a central explanatory variable (Prochaska et al., 1992; Rosenstock, 1975; Weinstein, 1988). *Perceived risk* refers to one's belief about the probability that the health problem will be experienced. The aforementioned assumption has been substantiated empirically in the area of breast cancer research. Two meta-analyses of research studies reported that perceived risk for developing breast cancer was a significant predictor of adopting mammography screening (Katapodi et al., 2004; McCaul et al., 1996).

Further research is needed in order to understand how individuals assess their own susceptibility to disease and how they decide whether they are at risk for one or the other health problem. Judgment and decision-making theory suggests that when people have to make predictions and judgments about uncertain events, they often employ a number of mental rules of thumb, called *heuristics*. Heuristics are logical shortcuts or affective evaluations that are used during information processing; they reduce complex mental operations to simpler cognitive tasks, and thus, simplify the decision-making process and reduce cognitive demands and psychological stress (Kahneman, Slovic, & Tversky, 1982; Loewenstein, Weber, Hsee, & Welch, 2001; Nisbett & Ross, 1980; Slovic, Finucane, Peters, & MacGregor, 2002). Although heuristics facilitate risk assessments, they can produce both valid and invalid judgments, and can lead to characteristic systematic errors.

Research on heuristics can help us understand how and why people underestimate or overestimate their cancer risk. For example, numerous theoretical and empirical studies suggested that

Research regarding the possible influence of heuristic thinking on perceived breast cancer risk revealed a connection between personal experiences, risk perceptions, and specific heuristics. Experiences with affected family members are incorporated into risk perceptions through the availability, representativeness, and anchoring and adjustment heuristics (Rees, Fry, & Cull, 2001), and through the availability and perceived control heuristics (Facione, 2002). Experiences with affected friends are incorporated into risk perceptions through the availability heuristic (Montgomery, Erblich, DiLorenzo, & Bovbjerg, 2003). In previous work we expanded our understanding of the connections between perceived breast cancer risk, and the simulation, perceived control, affect, and loss aversion heuristics (Katapodi, Facione, Humphreys, & Dodd, 2005). Inappropriate use of heuristics resulted in subsequent risk assessments that were not accurate. Some women with a positive family history made claims of being at lower risk; although they were aware that heredity is a risk factor, they claimed being at lower risk because they were not emotionally close to their mother or they did not physically look like her (Katapodi et al., 2005).

the affective evaluation of a stimulus, and conscious or unconscious feeling states make great

contributions to risk assessments (Loewenstein et al., 2001; Slovic et al., 2002). Affective

evaluations might make a threat more vivid and personal, and therefore, might reduce tendencies

to deny vulnerability. Alternatively, the desire to reduce worry and to avoid feeling afraid may

lead to discounting threatening information, and therefore, create an optimistic bias (Weinstein,

1980, 1989). Others have suggested a bidirectional relation between risk assessments and affect

(Easterling & Leventhal, 1989; Leventhal & Leventhal, 2003; Leventhal, Meyer, & Nerenz,

1980). Although heuristics facilitate risk assessments, they can produce both valid and invalid

judgments, and can lead to characteristic systematic errors.

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2005). Inappropriate use of heuristics resulted in subsequent risk assessments that were not

accurate. Some women with a positive family history made claims of being at lower risk;

although they were aware that heredity is a risk factor, they claimed being at lower risk because

they were not emotionally close to their mother or they did not physically look like her (Katapodi

et al., 2005).

Therefore, tailored educational interventions should aim to discount risk assessments that are based on information that is subject to heuristics and biases, and foster risk assessments that are based on factual information. Research should examine the substantive variables that in combination with heuristic thinking act as barriers to comprehension and responsiveness to health messages. The purpose of the present study was to examine the connections between personal experiences, heuristic thinking, and optimistic bias. First, we examined whether experiences with affected friends helped women decrease their optimistic bias. Second, we examined whether women with objective breast cancer risk factors, such as a positive family history and abnormal breast symptoms had an optimistic bias. Third, we examined whether optimistic bias was reduced through factual knowledge of risk factors or through affective responses. Consequently, we examined whether knowledge of risk factors and breast cancer worry acted as moderators or mediators between personal experiences and optimistic bias. In other words, we examined whether women's experiences with the disease decrease optimistic bias via affective reactions or via inferential reasoning.

There are indications that people's perceptions of vulnerability to disease are determined by social comparisons (Weinstein & Klein, 1995) that might influence self-assessment beyond absolute probability information (Klein & Weinstein, 1997; Windschitl, Martin, & Flugstad, 2002). Studies have been using two different approaches for assessing perceived breast cancer risk: assessing absolute risk judgments (how likely is breast cancer to happen to me?), and assessing comparative risk judgments (how do my chances of getting breast cancer compare to those of my peers or other women my age?). Absolute risk judgments depend on the individual's

perceived standing on relevant risk factors, while comparative risk judgments are made against a

comparison standard. Although absolute and comparative risk judgments are closely correlated,

there is no consensus whether they reflect a single construct of susceptibility and could be used

interchangeably (Gerend, Aiken, West, & Erchull, 2004) or not (Smith, Gerrard, & Gibbons,

1997; Weinstein, 1984).

Norm theory proposes that reasoning flows both forward and backward (Kahneman & Miller,

1986) . Forward reasoning flows from anticipation and hypothesis to confirmation or revision,

while backward reasoning flows from the experience of what a stimulus reminds us of or what it

makes us think about. Risk judgments either express anticipation and project into the future

(absolute judgment) or are constructed through comparisons of the stimulus probe with

counterfactual alternatives (comparative judgment). Comparative judgments are made against a

standard retrieved from stored knowledge or against an exemplar that is recruited for the

judgment (Kahneman & Miller, 1986).

Acknowledging personal susceptibility occurs through individualized information about personal

risk factors, a close experience with the health problem, and through information about the risk

status and protective behaviors of one's peers (Weinstein & Klein, 1995). Individualized

information on one's risk factors would be expected to influence absolute risk judgments,

whereas information on the risk status of one's peers would be expected to influence comparative

risk judgments. Individuals who perceive themselves to be at high risk for a disease are more

likely to take appropriate actions in order to reduce their risk, which results in a positive

correlation between perceived risk and adoption of precautions (Weinstein & Nicolich, 1993).

Optimistic bias can be demonstrated either with a *direct* or an *indirect* method. With the *direct*

method, participants are asked directly to compare themselves to others with similar

characteristics or to an average person. If unbiased, the distribution of responses should center

on the average response, whereas a substantial skew in the distribution indicates a systematic

bias. Studies that used a direct method of assessing comparison judgments demonstrated that

people systematically believed that they were better than others in various ways (Alicke et al.,

1995; Messick et al., 1985; Svenson, 1981), thus demonstrating a *better-than-average effect*.

With the *indirect method* participants are asked, first to make an absolute risk judgment about

themselves, and then to make an absolute risk judgment of others. The difference between the

two risk judgments is an indirect measure of an individual's perceived risk. Studies that used an

indirect method for assessing comparison judgments reported that people systematically give a

better absolute judgment to themselves than to others, thus demonstrating a *comparative-*

optimism effect (Klein & Weinstein, 1997; Weinstein, 1980, 1982, 1983, 1984, 1987; Weinstein

& Klein, 1995).

Methods

Recruitment and Procedures

This cross-sectional survey was titled "Women's Breast Health Study" and recruited a

community sample from the San Francisco Bay Area. Recruitment was done through

advertisements placed in newspapers targeting ethnic minority groups. In addition, flyers were

posted on bulleting boards of community places that potential participants were likely to visit in

their daily living, such as workplaces, senior and cultural centers, libraries, restaurants, grocery

and coffee shops, churches and temples, and shelters for homeless and battered women.

Women were eligible to participate if they were between the ages of 30 and 85, had never

been diagnosed with any type of cancer, and were willing to complete a questionnaire in English.

The minimum age limit of 30 years was chosen because some aggressive types of breast cancer

occur in women in their thirties (American Cancer Society, 2008). The maximum age limit was

set at 85 years because that is the maximum age that breast cancer risk can be estimated

objectively (Gail et al., 1989). Women with a prior diagnosis of any type of cancer were

excluded from the study because they are more likely to have received extensive education about

their risk factors.

Potential participants responded by calling a dedicated telephone number. Eligibility was

determined by the first author based on women's reports. Two hundred and three women called

and expressed their interest in the study. However, 19 were excluded – three had a previous

cancer diagnosis, 12 were younger than 30 years of age, and four decided that they were not

interested in the study – leaving a final sample of N=184 women. Participants completed the

survey in a place and time of their choice and were paid $15. The study protocol was approved

by the ethics committees of the funding agent and of a major research institution.

Measures

Experiences with breast cancer among family members and friends

    Family History of breast cancer was assessed by asking participants to indicate the number of their First-Degree Relatives (FDRs) {mother, sister(s)} and Second-Degree Relatives (SDRs) {aunt(s), uncle(s), and grandmother(s)} that have been affected by the disease. A continuous variable was created indicating the total number of affected family members for each participant. *Number of Affected Friends/Peers* indicated the extent that participants had experiences with the disease within their social networks.

Personal experiences with abnormal breast symptoms

    We asked participants to indicate the *Number of Breast Biopsies* they ever had and we created a continuous variable based on their responses. We also asked participants whether they were experiencing any breast symptoms at the time of the survey. *Current Breast Symptoms* were assessed with the Breast Cancer Symptom Scale (Facione, Miaskowski, Dodd, & Paul, 2002). According to a panel of four nurses (M.D., N.F., K.L., and J.H.), who are experts in research on symptom management (Dodd et al., 2001), each symptom was assigned a score between '1' and '4' indicating the potential severity of the symptom. For example, "breasts feel painful and tender during menstruation" was scored as '1', whereas "a little blood is coming out my nipple" was scored as '4.' Participants could respond *"Yes", "No"*, and *"Don't Know"* for each breast symptom. Items that were scored *"Yes"* and *"Don't know"* were summed to represent each woman's report of incidence of breast symptoms. The scoring of ambiguous responses (*Don't know*) as affirmative was based on empirical findings suggesting that some women choose to describe a breast symptom in a non-threatening way in order to avoid mental

and psychological discomfort (Case, Andrews, Johnson, & Allard, 2005; Katapodi et al., 2005;

Prohaska, Keller, Leventhal, & Leventhal, 1987). (Table 2 describes the items).

Knowledge of Breast Cancer Risk Factors

We used the *Knowledge of Breast Cancer Risk Factors Index (BCRFKI),* (13-items,

Cronbach $\alpha = 0.80$), to assess knowledge of breast cancer risk factors. Five of these items

described risk factors identified by the Gail model (Royak-Schaler et al., 2002), while the

remaining eight items were developed to examine knowledge of hereditary/genetic risk factors

for breast cancer. Higher scores indicate greater knowledge of breast cancer risk factors.

Knowledge of breast cancer risk factors in the sample has been reported elsewhere (Katapodi &

Aouizerat, 2005).

Breast Cancer Worry

We used four items to assess *Breast Cancer Worry;* the items have been previously used

and validated (Easterling & Leventhal, 1989). Two items asked participants "*how often they had*

worried" and "*how emotionally upset or distressed*" they had been about the possibility of

getting breast cancer; responses ranged from '*0*' "*Never/Not at all*" to '*10*' "*All the time/A Great*

Deal." The other two items assessed "*current worry about the possibility of getting breast*

cancer" and "*worry about getting breast cancer when going to the doctor*"; responses ranged

from '*1*' "*Strongly Disagree*" to '*4*' "*Strongly Agree.*" Items were standardized before

summing and higher scores indicated greater breast cancer worry. Internal consistency for the

scale was high (Cronbach's $\alpha = 0.85$).

Perceived Breast Cancer Risk

We asked participants to rate the breast cancer risk of their friends/peers and their own

risk with two items: "*What do you think are the chances that your friends/peers (you) will*

develop breast cancer, during their (your) lifetime? On a scale from 0 (Definitely will NOT) to

10 (Definitely will) please circle one number that best describes your answer." The item asking

about the risk of friends/peers preceded the item asking about personal risk. In order to provide

women with appropriate context and to avoid misinterpretation of the scale that has been

reported elsewhere (Woloshin, Schwartz, Black, & Welch, 1999), the numbers were coupled

with five verbal anchors; '0' and '1' were coupled with "Definitely Will Not", '2' and '3' with

"Probably Will Not", '4', '5', and '6' with "Fifty-fifty", '7' and '8' with "Probably Will", '9' and

'10' with "Definitely Will." Approximately 10% of participants marked a point between two

numbers or marked a verbal anchor instead of circling a number. For those cases we took a

conservative approach and we used the corresponding number closest to the center of the scale.

Statistical Analyses

Data were analyzed using the SPSS 15® statistical program. We calculated individual

scores when at least 60% of items were completed. Distributions were checked for normality.

Power analysis indicated that a sample of N=147 would provide Power=0.80 to detect moderate

correlations among predictive variables (R^2 =0.13) with alpha=0.05. The goodness of fit for each

linear regression model was assessed using the model effect size (R^2) and ANOVA (F) tests. The

unique contribution of each predictor after controlling for other predictors was assessed with the

squared partial correlation (sr^2).

To reduce expected multicollinearity among predictors, variables were centered prior to

use in regression analyses. Centering removes non-essential multicollinearity that is due to

scaling and consists of subtracting the mean of each variable from each observed value (Cohen,

Cohen, West, & Aiken, 2002). Collinearity diagnostics was assessed with the Variance Inflation

Factor (V.I.F.). Multicollinearity was observed between educational level and knowledge of risk

factors; consequently, we removed educational level from all regression models retaining

knowledge of risk factors as a predictor, as it pertains specifically to perceived breast cancer risk.

V.I.F. was lower than 1.5 for all remaining predictors and in all models tested.

We explored whether worry and knowledge of breast cancer risk factors mediated or

moderated the relationships between predictive variables and perceived risk. To test for a

mediator effect we examined first, whether variations in the mediator [worry or knowledge]

predicted variations in perceived risk; second, whether variations in the independent variables

predicted variations in the mediator [worry or knowledge]; and third, whether the effect of the

independent variables on perceived risk becomes non-significant when the mediator is

controlled. To test for a moderator effect, predictors were entered simultaneously in the first step

of a hierarchical regression followed by the interaction term in the second step. A moderator

effect was present if the interaction term accounted for a statistically significant change in R-

squared of perceived risk. (Baron & Kenny, 1986).

Results

The final sample consisted of a multicultural sample of 184 women (Table 1). According

to the US Census (US Census, 2000), although the sample was broadly comparable to the San

Francisco Bay Area population, there was an over-representation of non-Hispanic black women

and women with college education. (Insert Table 1).

Approximately two thirds of participants (64%) did not have a family history of breast

cancer, while the majority (N=120, 65%) reported having at least one friend diagnosed with the

disease (Mean: 1.70 ± 1.83, Range: 0 - 7). Approximately one in five women (19%) had one or

more breast biopsies (Mean= 0.28 ± 0.71, Range: 0 - 5), while 49% reported at least one breast

symptom at the time of the survey. The most common symptom was "breasts feel painful and

tender during menstrual period" (45%). However, twelve women (7%) reported symptoms that could suggest a breast malignancy (Table 2). Participants reported moderate worry (Mean=8.15±3.32, Median=7.96, Range: 2.51 to 18.51) and had moderate levels of knowledge of breast cancer risk factors (Mean: 5.96±3.19, Median: 7.00, Range: 0-13). (Insert Table 2).

Participants reported that they *"Probably Will Not"* get the disease (X=3.57±1.70), while they rated their friends/peers at higher risk (X=4.35±1.56) (Katapodi, Dodd, Lee, Facione, & Cooper, 2004). Paired samples t-test revealed that overall, participants perceived that they were significantly less likely than their friends/peers to be affected by the disease ($t_{(179)}$ =5.64, p<.001). The majority of participants (51%) rated the risk of their friends/peers equal to their own risk (risk of others – personal risk =0). Few women (10%) had a pessimistic bias and rated their own risk as higher than the risk of their friends/peers (risk of others – personal risk <0, range: -7 to -1), whereas 39% rated the risk of their friends/peers as higher than their own (risk of others – personal risk >0, range: 1 to 8).

Predictors of Perceived Risk for Self and for Friends/Peers

We examined whether age, ethnicity, experiences with affected family members and friends, experiences with abnormal breast symptoms, worry, and knowledge of breast cancer risk factors predicted perceived breast cancer risk for self and for friends/peers. We performed two separate simultaneous regressions for each criterion variable. The two models were significant and the unique contribution of each variable (sr^2) is reported (Table 3). Number of affected family members and worry were significant predictors of perceived risk for self, while number of affected friends and self-identifying as African American were significant predictors of perceived risk for friends/peers (Insert Table 3).

Worry as a mediator between experiences and perceived risk for self

Since worry was a significant predictor of perceived risk for self, the first condition for a mediation effect to occur was satisfied. Therefore, we examined whether worry acted as mediator between predictor variables and perceived risk. We examined whether age, ethnicity, number of affected family members, number of affected friends, number of breast biopsies, and current breast symptoms predicted breast cancer worry. **The overall model was not significant, indicating that worry was not a mediator between predictors and perceived risk for self.**

Worry and knowledge of risk factors as moderators between experiences and perceived risk

We examined whether worry and knowledge of risk factors moderated the relationships between predictors and perceived risk for self and for friends/peers. We performed two separate hierarchical regressions for each proposed moderator and for each criterion variable. The model that tested whether knowledge was a moderator between predictors and perceived risk for friends/peers almost reached statistical significance ($R^2 = 0.21$, $\Delta R^2 = 0.08$, $\Delta F = 1.93$, $p = 0.06$); the only significant interaction was observed between knowledge and self-identifying as Latino ($sr^2 = 0.04$, $B_{Inter\_Know\_Lat} = -0.92$, 95%CI $-1.82 - -0.02$, $p = 0.05$).

Predictors of Risk Difference [Risk for Friends/Peers – Risk for Self]

We created a measure of Risk Difference by subtracting the risk value that women assigned to themselves from the risk value they assigned to their peers (Risk Difference = Risk for Friends/Peers –Risk for Self). Values of the measure were normally distributed (X= 0.78±1.85, Md=0, Range: -7.00 to 8.00), with positive scores indicating an optimistic bias. To examine the extent to which perceived risk difference was related to experiences with affected family members, affected friends, abnormal breast symptoms, worry, and knowledge of breast cancer risk factors, we performed a simultaneous regression analysis. The overall model was

significant and the unique contribution of each variable (sr^2) is reported (Table 4). (Insert Table

4).

We examined whether worry and knowledge of risk factors moderated the relationships

between experiences with the disease and risk difference. We performed two separate

hierarchical regressions for each proposed moderator. Worry was a moderator for age and for

current breast symptoms, whereas knowledge of risk factors was a moderator for age, number of

breast biopsies, and self identifying as Latino. (Table 5). (Insert Table 5).

Discussion

The study examined whether experiences with affected family members, affected friends, and breast symptoms decreased optimistic bias about breast cancer risk, and whether knowledge of risk factors and worry acted as mediators or moderators between predictors and optimistic bias.

As expected, findings confirmed the significant role of family history in decreasing optimistic bias. From the four conditions of family history examined (no family history, one affected FDR, =1 affected SDRs, or multiple affected family members), having one affected FDR did not decrease optimistic bias. This was an unexpected finding. Women with one affected FDR appear to be able to maintain an optimistic assessment regarding their breast cancer risk. This claim is in conflict with research quantifying breast cancer risk, which suggests that having one affected FDR can significantly increase one's risk for the disease (Gail et al., 1989). Although the study included a small and volunteer sample, our findings are consistent with other studies that included larger samples (Absetz et al., 2000; Aiken et al., 1995). This finding, and in combination with the moderate levels of knowledge of risk factors reported by study participants, implies a knowledge deficit. Health care providers either need to increase their efforts for educating community women about breast cancer risk factors, or need to implement a different approach when they deliver the message that having even one affected FDR can significantly increase breast cancer risk.

Despite the small number, having multiple affected family members had the greatest impact on optimistic bias. This experience was incorporated into risk assessments through two possible pathways: through a direct pathway and through an interaction with breast cancer worry. Since worry did not mediate the relation between family history and optimistic bias, findings do NOT support a causal pathway between family history, affect, and optimistic bias. This is consistent with reports that family history did not evoke worry among high risk women (Loescher, 2003). Moreover, the interaction of worry with family history did not have a significant overall effect on optimistic bias. Most of the variance was contributed from a weak moderation between worry and having multiple affected relatives. These findings, and in combination with the moderate amounts of participants' worry, imply that family history could reduce optimistic bias through an affective pathway, but ONLY when affect reaches a threshold. This affective pathway could be activated either by contextual variables that increase breast cancer worry, or by individual psychological differences (McGregor et al., 2004). In our data having current breast symptoms was a contextual variable that significantly increased breast cancer worry.

One would expect that the subjective risk evaluations of women with a positive family history would draw on the knowledge that that their own risk is increased due to genetic/hereditary risk factors. We were expecting to observe a causal pathway between family history and optimistic bias that operates through knowledge of risk factors. The first condition for the mediating role of knowledge between family history and optimistic bias was satisfied for multiple affected relatives and affected SDRs. However, subsequent analyses did not support such a mediating relation. This was a very surprising finding, given that 76% of the sample recognized that having affected family members was a risk factor (Katapodi & Aouizerat, 2005).

Instead, knowledge acted as a moderator between having affected SDRs and a decreased

optimistic bias. The latter relation represents a mediated moderation (Muller, Judd, & Yzerbyt,

2005), in which the magnitude of the overall effect of having affected SDRs on optimistic bias

depends on individual differences in factual knowledge of risk factors.

Taken together these findings suggest that experiences with affected family members

might be incorporated into risk assessments through a direct pathway, an affective pathway, and

a pathway that involves knowledge of actual risk factors. The first two pathways likely represent

heuristic thinking. The strongest effect was observed from the direct pathway generated from the

experience of having multiple affected family members. The availability, representativeness, and

possibly other heuristics influence assessments of personal risk. Similarly, the affective pathway

influences assessments of personal risk, and appears to be activated after contextually relevant

affect reaches a critical threshold. Another likely explanation for our findings is that repeated

experiences with affected family members represent opportunities for experiential learning

towards more accurate risk assessments. Having multiple and SDRs affected by the disease were

significant predictors of knowledge of risk factors. In addition, the observed moderation between

SDRs and knowledge suggests that optimistic bias could be maintained due to knowledge

deficits among some women with a positive family history. The connections between family

history, optimistic bias, and knowledge of risk factors need to be further examined for successful

implementation of interventions that aim to facilitate information processing.

Consistent with findings from seven studies (Katapodi et al., 2004), abnormal breast

symptoms decreased optimistic bias. Worry was a complete mediator between current symptoms

and optimistic bias, which implies a causal pathway from symptom appraisal to risk assessments

that operates through affect. However, having one or more breast biopsies did not decrease

optimistic bias. Another study reported that breast biopsies evoked worry (Andrykowski et al.,

2002), which was not true for participants in this study. Breast biopsies reduced optimistic bias

through an interaction with knowledge of risk factors. This implies that having one or more

breast biopsies represents opportunities for more accurate risk assessments through experiential

learning.

It is not clear why these two experiences with abnormal breast symptoms were

incorporated into risk assessments through different pathways: current breast symptoms appear to

follow an affective pathway, whereas experiences with breast biopsies appear to follow an

analytical pathway that depends on knowledge of risk factors. One possible explanation relates

to the timing of the experience and the cross-sectional design of the study. It is possible that

breast symptoms that were present when the study took place were concurrently being evaluated

for their catastrophic potential by the individual, whereas past experiences with breast biopsies

have been resolved. Evidence indicates that immediately after a breast biopsy women

experienced high levels of worry, which decreased over time (Andrykowski et al., 2002; Brett,

Austoker, & Ong, 1998). Worry probably is the initial response to a self-discovered breast

symptom. Ad hoc evaluations of such experiences decrease optimistic bias, but ONLY for

women who are aware that having dense breast tissue that needs to be assessed with a breast

biopsy constitutes a risk factor. It is possible that in order to reduce worry and fear that follow

the evaluation of the threat posed by a breast symptom, women maintain an optimistic bias

through other variables or other heuristic mechanisms, such as perceived control (Cunningham et

al., 1998; Kos & Clarke, 2001), and an inappropriate use of the illusion of control heuristic

(Katapodi et al., 2005). These findings imply that worry and inappropriate use of the illusion of

control heuristic might interfere with responsiveness to health messages and inhibit information

processing and retention. Therefore, timing of an intervention might be a crucial factor that

affects the effectiveness of the intervention. In support of this suggestion, evidence indicated that

women's responses to risk information were influenced by pre-counseling levels of worry

(Gurmankin, Domchek, Stopfer, Felds, & Armstrong, 2005).

Women who had one or more friends/peers diagnosed with the disease were more likely

to have an optimistic bias. This was a surprising finding, because it is conflicting with previous

reports (Facione, 2002; Montgomery et al., 2003). One possible explanation is that the 120

women who had affected friends made the assessment of being at lower risk compared to those

friends, based on the reasonable assumption that having had breast cancer before increases the

likelihood of a second primary breast cancer and for recurrence of the disease. Although we

elicited women's knowledge of this particular risk factor, knowledge did not moderate the

relation between optimistic bias and affected friends. Affected friends had a direct, positive

effect on optimistic bias, which can be attributed to the availability heuristic. The availability

heuristic may influence optimistic bias in two ways. On one hand, women with none or one

affected friend do not have enough available examples to recall, and thus find it harder to

imagine being personally affected by the disease (Facione, 2002; Montgomery et al., 2003). On

the other hand, it has been suggested that the self-relevance of the recalled information dictates

whether the individual will use a heuristic or a deliberate information processing strategy for

subsequent risk assessments (Schwarz & Vaughn, 2002). In the context of the present study, it is

possible that knowing women with breast cancer promotes a heuristic evaluation of the risk of

friends/peers. This heuristic evaluation increases the likelihood judgment for *others getting*

breast cancer, thus contributing to optimistic bias. This suggestion has direct implications for

educational interventions that aim to increase accuracy of risk assessments by presenting general

risk factors or exemplars of women that have been affected by the disease. It is possible that

such interventions actually increase optimistic bias.

The limitations of the study should be considered, to properly temper any conclusions.

The results are based on a convenience sample of self-selected, English-speaking, and mostly

inner-city women. Assessment of risk factors and breast symptoms was based on self-report.

Although we examined knowledge of important breast cancer risk factors our list was not

exhaustive. Moreover, the stability of these relationships is limited by the fact that our sample

was not large enough to include a large number of women with a positive family history and

other risk factors. Finally, we acknowledge that optimistic bias might be related to psychological

variables that serve self-enhancement and adaptation (Bonnano, 2004; Bowen, Morasca, &

Meischke, 2003), which were not examined in this study. Despite these limitations, the strength

of the study is that it recruited women from diverse socioeconomic and racial/cultural

backgrounds from community settings, which ensured that participation in the study was not

limited to women that have greater access to health care services, and thus have greater

opportunities to attend health related messages.

Our findings have implications for interventions that aim to facilitate information

processing and decision-making by providing tailored health messages. They help explain why

educational interventions are not always successful among individual women in changing pre-

existing belief systems. Health educators need to assess pre-existing bias that affects women's

responsiveness to health messages. Besides assessing knowledge deficits, they need to consider

inappropriate use of heuristics, and assess whether contextual variables activate different

information processing mechanisms. These suggestions might open new avenues to risk

communication research.

To check for the possibility that demographic characteristics such as age, education, income, and race/culture were predictors of optimistic bias we performed a simultaneous regression analysis; demographic variables were entered into a regression equation in one step. None was a significant predictor of optimistic bias, which is consistent with a previous report (Weinstein, 1987). Moreover, in the subsequent analyses reported below none of these variables had a significant effect on the overall model, therefore, we excluded them from analyses presented in this paper.

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Appendix

Table 1. Demographic Characteristics of the Sample

Variable		N	%
Age	X= 46.59±12.05, range: 30 to 84		
	Missing	6	3
	Total	184	
Race/Culture			
	Non-Hispanic White	79	43
	Non-Hispanic African-descent	50	27
	Hispanic	25	14
	Asian-descent	30	16
Education			
	Grades 1 to 8, Elementary School	7	4
	Grades 9 to 11, some High School	8	4
	Grade 12, or GED, High School Graduate	31	17
	College 1 to 3 years, some College or Technical School	48	26
	College ≥ 4 years, College Graduate	90	49
Annual Family Income			
	<$10,000	39	21
	$10,000 – $20,000	16	9
	$20,000 - $30,000	33	18
	$30,000 - $40,000	28	15
	$40,000 - $50,000	17	9
	$50,000 - $60,000	16	9
	$60,000 - $70,000	6	3
	>$70,000	21	11
	Missing	8	5

Table 2. Experiences with Breast Cancer

Family History			
	No Family History	117	64
	≥1 affected SDR	24	13
	1 affected FDR	18	10
	Multiple (>1 FDR or ≥1FDR and ≥1 SDR)	16	9
	Missing	9	4
Current Breast Symptoms			
	No Symptom	90	49
	Breasts feel painful and tender during menstruation	83	45
	A vague change in the breast	8	4
	One or both breasts look different than usual	6	3
	A change in the shape of one breast	5	3
	Itching on the skin of the breast	23	13
	Constant sharp pains on one breast	12	7
	One breast getting larger	10	5
	Clear liquid is coming out of one nipple	6	3
	A lump or thickening in the breast that you have not noticed before	6	3
	One breast feels warm and swollen	5	3
	A sore or a scab in the nipple	4	2
	The skin or the nipple looks scaly	4	2
	Ridges or pitting of the skin of the breast	3	2
	The nipple is pooled back and is sinking into the breast	4	2
	One breast looks red	2	1
	A lump that is getting bigger	2	1
	The skin of the breast looks like the skin of an orange	1	.5
	A little blood is coming out of the nipple	0	0

SDR: Second-Degree Relative
FDR: First-Degree Relative

Table 3. Predictors of Perceived Breast Cancer Risk

Criterion Variable: Perceived Risk for Self

Predictors	R^2 0.24	ΔR^2 0.24	ΔF 4.76**	sr^2	B	95%CI for B	
Age				0.03	-0.20	-0.44	0.05
African American vs. White				0.01	0.21	-0.40	0.81
Latino vs. White				<0.01	0.16	-0.62	0.94
Asian American vs. White				<0.01	0.18	-0.52	0.89
Number of Affected Family				0.08	0.35*	0.11	0.58
Number of Affected Friends				<0.01	0.04	-0.21	0.29
Number of Breast Biopsies				<0.01	-0.11	-0.33	0.12
Current Breast Symptoms				0.04	0.13	-0.11	0.38
Worry				0.15	0.64**	0.36	0.93
Knowledge of Risk Factors				<0.01	0.09	-0.15	0.33

Criterion Variable: Perceived Risk for Friends/Peers

Predictors	R^2 0.12	ΔR^2 0.12	ΔF 2.09*	sr^2	B	95%CI for B	
Age				>0.01	0.01	-0.23	0.24
African American vs. White				0.05	0.68*	0.10	1.16
Latino vs. White				>0.01	0.45	-0.30	1.19
Asian American vs. White				0.01	-0.04	-0.72	0.63
Number of Affected Family				>0.01	-0.05	-0.24	0.23
Number of Affected Friends				0.03	0.29*	0.04	0.53
Number of Breast Biopsies				>0.01	-0.18	-0.39	0.40
Current Breast Symptoms				0.02	0.13	-0.11	0.36
Worry				0.01	0.09	-0.19	0.36
Knowledge of Risk Factors				>0.01	-0.09	-0.33	0.16

R^2 = Proportion of variance in the criterion variable explained by the equation

ΔF = Change in F test, comparing this model to the null model

sr^2 = Squared partial correlation. Proportion of variance explained by one predictor while other predictors are controlled

B = Un-standardized regression coefficient indicating the change in the criterion variable associated with the specific predictor

*p=0.05, **p=0.001

Table 4. Predictors of Risk Difference

	R^2	ΔR^2	ΔF	sr^2	B	95%CI for B	
Criterion Variable: Risk Difference (Risk for Friends/Peers – Risk for Self)							
Predictors	0.17	0.163	3.08**				
Age				0.01	0.22	-0.08	0.52
African American vs. White				<0.01	0.51	-0.22	1.24
Latino vs. White				<0.01	0.28	-0.65	1.22
Asian American vs. White				<0.01	-0.11	-0.95	0.74
Number of Affected Family				0.03	-0.28*	-0.56	-0.01
Number of Affected Friends				0.02	0.23	-0.07	0.54
Number of Breast Biopsies				<0.01	-0.06	-0.34	0.21
Current Breast Symptoms				<0.01	-0.04	-0.34	0.25
Worry				0.06	-0.55*	-0.89	-0.20
Knowledge of Risk Factors				0.02	-0.29*	-0.58	-0.06
Interaction Predictors × Worry	0.28	0.11	2.38*				
Age × Worry				0.03	0.36*	0.09	0.73
African American vs. White × Worry				<0.01	0.11	-0.84	1.05
Latino vs. White × Worry				<0.01	0.49	-0.55	1.54
Asian American vs. White × Worry				0.01	0.70	-0.37	1.77
Number of Affected Family × Worry				0.02	0.22	-0.053	0.08
Number of Affected Friends × Worry				0.02	-0.35	-0.77	0.07
Number of Breast Biopsies × Worry				<0.01	0.39	-0.49	1.27
Current Breast Symptoms × Worry				0.05	1.45*	0.36	2.54
Interaction Predictors × Knowledge	0.32	0.15	3.69**				
Age × Knowledge				0.07	-0.53**	-0.84	-0.21
African American vs. White × Knowledge				<0.01	-0.42	-1.15	0.30
Latino vs. White × Knowledge				0.03	-1.18*	-2.23	-0.12
Asian American vs. White × Knowledge				0.01	0.56	-1.35	0.22
Number of Affected Family × Knowledge				<0.01	-0.03	-0.44	0.44
Number of Affected Friends × Knowledge				<0.01	0.02	-0.37	0.41
Number of Breast Biopsies × Knowledge				0.03	-0.35*	-0.66	-0.04
Current Breast Symptoms × Knowledge				<0.01	-0.39	-1.25	0.47

R^2 = Proportion of variance in the criterion variable explained by the equation

ΔF = Change in F test, comparing this model to the null model

sr^2 = Squared partial correlation. Proportion of variance explained by one predictor while other predictors are controlled

B = Un-standardized regression coefficient indicating the change in the criterion variable associated with the specific predictor

*p=0.05, **p=0.001

Figure 1. Graphic representation of findings